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ABSTRACT

This is one of several short-term courses developed to assist in the training of waste water treatment plant operational personnel in the tests, measurements, and report preparation required for compliance with their NPDES Permits. The Staff Guide provides step-by-step information on course planning, development, and implementation involving classroom instruction and laboratory application of critical learning outcomes. Part I is concerned with the administrative aspects of the training program. Part II consists of instructional staff guidelines on technical content, learning objectives, and lesson-by-lesson guides for the self-monitoring procedures contained in this course. (CS)

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EPA-430/1-77-006

EFFLUENT MONITORING PROCEDURES: METALS ANALYSES

ED147191

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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STAFF GUIDE

U.S. ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF WATER PROGRAM OPERATIONS

SE 023 379

STAFF GUIDE

for

CONDUCTING THE COURSE

EFFLUENT MONITORING PROCEDURES: METALS ANALYSES

National Training and Operational Technology Center
Municipal Operations and Training Division
Office of Water Program Operations
U.S. Environmental Protection Agency

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PREFACE

TO THE USER OF THIS MANUAL

Background of Effluent Self-Monitoring Requirement

With passage of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) a new permit program was created to replace and improve upon the earlier permit system which existed under the 1899 Refuse Act.

Under the 1972 Act, the United States Environmental Protection Agency is required to establish national effluent limitations and national treatment performance standards for all sources of water pollution, including not only municipal discharges, but also factories, animal feedlots, and power plants. These effluent limitations are the maximum amount of a pollutant that any discharger may release into a water body.

In order to insure that the prescribed effluent limits are met, every discharger is required to obtain an NPDES (National Pollutant Discharge Elimination System) Permit. Types of water discharge sources for which a permit is required include municipal wastewater treatment facilities; manufacturing plants; agriculture, forestry, mining and fishing operations, and other service, wholesale, retail, and commercial establishments having operations which result in discharge of water to the Nation's bodies of water.

The NPDES Permit is not a license to pollute. To the contrary, a Permit stipulates what may be discharged, and how much may be discharged over a defined period of time. Each Permit is tailored to the discharger, and sets specific limits on each effluent.

Furthermore, the NPDES Permit also requires dischargers to monitor their effluents, performing specified tests and measurements at designated frequencies specified in the individual Permit, and to report the amount and nature of all waste components discharged.

Training Need Associated with Self-Monitoring Requirements

Compliance with NPDES requires that all specified tests and measurements be performed in accordance with methods specified by EPA and announced in the Federal Register. Only under very limited conditions are deviations from specified methods acceptable.

These requirements are the basis of an immediate, massive, training need to provide the responsible waste water treatment personnel with the knowledge and skills required to comply with the self-monitoring requirement. There is at present a wide range of initial capabilities for performing the tests and measurements. This ranges from the situation in the large, fully-staffed, fully-equipped facility in which little or no training is required, through all shades and levels to the limited staff in small, inadequately-equipped facilities in which at present there is little or no capability for performing the required tests and measurements.

This is one of several special short-term courses recently developed and currently under development by the Environmental Protection Agency and associated educational institutions. This Instructor's Guide is intended to assist other training organizations in conducting training of waste water treatment plant operational personnel in the tests, measurements, and report preparation required for compliance with their NPDES Permits.

TRAINING AVAILABLE OR UNDER DEVELOPMENT TO MEET SELF-MONITORING REQUIREMENTS

Title	Workers should take this who:
Basic Laboratory Skills for Self-Monitoring Tests and Measurements	Have little or no laboratory experience or training, and need to develop basic skills including use of balances; preparation of solutions and reagents; names, characteristics, preparation and care of common laboratory equipment supplies. This course prepares students requiring such training for entry into the following named courses in which procedures for designated tests and measurements are learned.
Self-Monitoring Procedures: Basic Parameters for Municipal Effluents	Have basic laboratory skills, as designated above, but need to learn one or more of the procedures required for most or all municipal effluents including BOD, fecal coliform, pH, suspended solids, flow, and reporting of results.
Effluent Monitoring Procedures: Metals Analyses	Usually have completed the "Basic Parameters" course, but have a Permit which requires report on one or more metals.
Effluent Monitoring Procedures: Nutrients	Usually have completed the "Basic Parameters" course, but have a Permit which requires periodic report on one or more of the so-called "nutrients" including nitrogen and phosphorus.
Effluent Monitoring Procedures: Flow Measurement and Sampling Techniques	Have made arrangements whereby the required laboratory procedures are performed elsewhere by contract or other special arrangement, and who are required only to collect and care for samples, and to make such tests and measurements as must be made at the sampling site.
Any of the analytical courses of EPA National Training and Operational Technology Center for specific Permits	Are professional chemists, microbiologists, or key laboratory technicians in large treatment facilities where they work full-time doing a designated series of analytical tests and measurements.

A Personal Note to the User of this Guide

The need for providing this training, and the nature of current efforts of the Environmental Protection Agency to meet this need have been discussed in foregoing paragraphs.

It is an oversimplification of a classic quotation to say that all that is needed to conduct training is to "put Mark Hopkins on one end of a log and a student on the other." It is almost as much an oversimplification to say that all that is needed to conduct a course is to bring together the students and the instructional staff in a classroom and laboratory equipped with requisite equipment and supplies for the instruction to be delivered.

A short course such as this, involving both classroom instruction and laboratory application, and with critical learning outcomes to be achieved within a limited period of time, absolutely requires careful, detailed planning, preparation, and implementation. Meticulous attention to detail and effective staff teamwork are essential at every step of course planning, development, and implementation.

The purpose of this Staff Guide is to provide you, the training staff member, with useful, practical assistance in presenting this course in your own facilities. The Guide is a resource. It is not a blueprint to be followed rigidly or unthinkingly. Even with this guide or any other form of assistance, you will have to plan, to think and to prepare in order to perform effectively in conducting this course. On the other hand, this Guide should be helpful in reducing the amount of original development work you will have to do, and it should be helpful in suggesting factors in course planning and presentation which otherwise might be ignored or glossed over.

You are invited, in fact requested, to participate actively in making this Guide a living document which effectively represents the best experience of all in planning, preparing for, conducting and terminating this course. Please provide this office with your constructive suggestions for strengthening and improving upon this Guide, based on your own experiences in conducting the course. Your recommendations will be fully considered in future editions of this and other Staff Guides for other courses of this series. In the event that questions arise in interpretation of any aspect of this Instructors' Guide, please write or call:

Director, National Training and Operational Technology Center
Office of Water Program Operations
U.S. Environmental Protection Agency
Cincinnati, OH 45268

Telephone: (513) 684-7501

Format of this Manual

This manual consists of two major parts. Part I is concerned with administrative aspects of planning, preparing, and conducting the course. Part II consists of guidance to the instructional staff on the technical content, learning objectives to be achieved by the students, and lesson-by-lesson instructional guides for each of the several self-monitoring procedures covered in this course.

Part I, which immediately follows, will have greatest value to those conducting this course for the first time or for the first few times. With practice in conducting the training most organizations will develop their own adaptations and ramifications of this plan to meet their own requirements and the specific situation.

It is strongly urged that each institution conducting this training course develop its own formal version of such a guide as this. Staff does change; new personnel require indoctrination and training on standard procedures of the organization they have joined. Rules and procedures promulgated by regulatory authority do change; such changes will require adjustment in course content. With repetition of specified tasks, many staff members, however dedicated, do slip into unconscious variations in practice or omissions in details which can subtly change the character of the course. A formal plan and guide, consciously studied and followed, can help the training instructor and the administrator to avoid many pitfalls.

Intelligent use of a plan such as this, with variations as proven necessary, can go far in keeping this course in harmony with the needs of the students and with requirements of regulatory authorities. Above all, the course should remain free of the distractions and last-minute corrections of errors or omissions discovered at untimely stages in course preparation and presentation.

PART I - COURSE PLANNING AND MANAGEMENT

A. Course Plan and Working Schedules

This section considers five topics:

Responsibilities in self-monitoring training

It is an inherent responsibility of any teacher to provide a learning situation which gives the student the best possible opportunity to develop the target level of knowledge and skills.

In addition, and not to be overlooked, this course involves a responsibility to the regulatory agency--to assure that students acquire specified knowledge and skills and that these skills are acquired to a level such that data reported by the student will be accepted as reliable by the regulatory authority.

Announcing the course

This section gives examples of course announcements, and identifies specific information which should be provided in any course announcement.

Summary plan for the course

This is a one-page summary of the course plan in which the reader can discover the subject matter coverage, days and approximate time allocations and the designation of the instructional specialty involved in presenting the instruction.

Sample course schedule

This covers the same information as the summary plan. The format is different, providing a day-by-day, hour-by-hour class schedule. This schedule-format has been found most practical at EPA training centers for more than 20 years. It works. It is recommended for your use.

Milestones in course planning and preparation

Each member of the training staff has individual and cooperative duties in planning and conducting the course. Much of the responsibility of each staff member is outlined later in this Guide in the section on Training Staff (Outline 6). The milestone chart shown here is an example of a plan to accomplish necessary tasks in a timely manner. It is necessary that each training institution develop its own logistics of course preparation to meet the situation at hand. It is urged that a formal milestone chart be developed.

1. Responsibilities in Self-Monitoring Training

a. Implications of NPDES

Each Permit issued under the National Pollutant Discharge Elimination System (NPDES) includes a program of required self-monitoring analyses of effluents and reporting of results at prescribed intervals.

1) The methodology to be followed in performing the self-monitoring tests and measurements is described in issuances in the Federal Register (FR).

2) In some cases, two or more alternative procedures are available to the analyst for compliance with monitoring requirements.

3) Provisions do exist whereby the regulatory agencies (State and EPA) can recommend and permit use of methods not listed in the FR. Procedures for orderly application of accepted methods are described in the FR issuance at the end of this section. It cannot be too strongly emphasized that the Permit-holder does not have the authority to make a unilateral decision to introduce analytical procedures not found in the FR issuances or not specifically authorized by the appropriate regulatory authorities.

b. Training Response to NPDES/FR Requirements

1) Methods taught in this and associated courses developed by EPA are limited to those most recently prescribed in issuances of the FR.

2) Usually, when alternative methods are available, the course will include only one of the alternatives. In planning the details of a specific course offering, a training representative should in every case consult with responsible representatives of the regulatory agency in the area in which the course is conducted. This consultation should include determination of:

a) Which, if any, of more than one alternative analytical method is preferred (or required) by the regulatory agency for the Permit-holders under its jurisdiction?

b) What, if any, changes have occurred since the last course offerings which require adjustment in course content?

c) What advice does the regulatory agency have to offer about the planned course presentation based on problems encountered in implementation of self-monitoring procedures, and in observations of performance of past graduates from previous offerings of the course?

3) The training institution which fails to apply these elementary practices, with a result of sometimes teaching inappropriate methods, stands in danger of committing a serious disservice to those it purports to serve:

a) To the students enrolled in the course; and

b) To the Permit-holding organization, which is being led to believe that through this training the qualifying student will perform self monitoring tests and measurements in accordance with methods approved by the regulatory authority.

c. Responsibilities in Accreditation of Students

1). Successful completion of this course of training will be a factor used by many regulatory agencies in the accreditation or certification of treatment plant personnel to perform self-monitoring tests and measurements.

2) The instructional staff has a responsibility to provide a learning experience through which the qualifying student will have every expectation of being able to perform the required self-monitoring procedures in a satisfactory manner on return to his normal working environment.

3) Student Evaluation and Testing

For permanent record of qualification and performance, a record of student performance should be made.

a) Tests (both written and applied) should be criterion tests, i.e., designed to demonstrate ability of the student to perform the required analyses, as contrasted with tests designed to develop a comparative rating of the individual students.

b) Written tests should be strictly applied to the procedures being taught and should be appropriate to a written answer. Thus definitions, matters of specific information, solving of problems, and similar matters are appropriate to written tests.

c) Many students will take alarm at written tests, and may not perform up to expectations due to this alarm. One means of alleviating this fear is to give open-book quizzes but to expect a high standard of performance. It is pointed out here that it is more important for the student to know where to refer for needed facts and to check these facts, than it is to demonstrate rote memory. The memory will come with practice of the test procedures. The student should learn to check the facts when in doubt, rather than to risk a blunder.

d) Much of the student evaluation will be based on performance in the laboratory. It will be appropriate to keep records on such factors in student performance as:

(1) Accuracy in following directions as given;

(2) Demonstration of acceptable manipulative skills;

(3) Reporting of laboratory results falling within acceptable relationship to a class norm; and other factors as determined by the instructor.

e) Each instructor is responsible for reporting the quality of performance of each student for the procedures for which he has primary responsibility. These reports should be written, and they should be made a part of the permanent course record. This course plan provides for having at least two instructors in the laboratory during all laboratory phases of the course. At any

given session, one instructor will be the designated primary instructor, with others in a supporting role. To make a system like this work satisfactorily in evaluation of students and to assure consistence in student instruction each member of the instructional team has defninte, if implied, responsibilities. These include:

(1) The primary instructor is the individual who reports on acceptability or non-acceptability of student performance.

(2) The instructor-assistant(s) must instruct students in the same way as designated by the primary instructor. Introduction of individuality in manipulative procedures, order of proceeding with a test, etc., can only confuse the student.

(3) The instructor-assistant(s) should bring the problem-student to the attention of the primary instructor at the earliest possible moment. This is to provide maximum opportunity to correct problems which might result in failure of the student to qualify in a given analytical procedure.

(4) Primary instructor and instructor-assistants have, of course, a continuing responsibility of preserving the highest standards of professional and ethical relationships with each other throughout the course. Differences of opinion will arise among individuals of any instructional staff. These differences must be resolved outside the classroom and laboratory. Furthermore, these differences are not subjects for airing with students at any time.

4) The Nonqualifying Student

a) There is a job/financial implication to any student failing to qualify for any of the analytical tests and measurements included in this course. Therefore instructors should be particularly careful to <u>document</u> the reasons for any nonqualification.

b) Any nonqualifying student should be entitled to be informed on the reasons why he is judged nonqualifying.

c) Ideally, an opportunity should be provided for nonqualifying students to have another chance to correct deficiencies in their performance. This could be accomplished through a number of different approaches such as makeup work (evenings) during the course itself, through repeating the training module in which acceptable results were not achieved (at a mutually agreeable time for the student and for the instructor), or by enrollment in a future offering of the course with participation only in the module which was failed the first time around.

federal register

WEDNESDAY, DECEMBER 1, 1976

PART II:

ENVIRONMENTAL PROTECTION AGENCY

■

WATER PROGRAMS

Guidelines Establishing Test Procedures for the Analysis of Pollutants

Amendments

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

SUBCHAPTER D—WATER PROGRAMS

[FRL 630-5]

PART 136—GUIDELINES ESTABLISHING TEST PROCEDURES FOR THE ANALYSIS OF POLLUTANTS

Amendment of Regulations

On June 9, 1975, proposed amendments to the Guidelines Establishing Test Procedures for the Analysis of Pollutants (40 CFR 136) were published in the FEDERAL REGISTER (40 FR 24535) as required by section 304(g) of the Federal Water Pollution Control Act Amendments of 1972 (86 Stat. 816, et seq., Pub. L. 92-500, 1972) hereinafter referred to as the Act.

Section 304(g) of the Act requires that the Administrator shall promulgate guidelines establishing test procedures for the analysis of pollutants that shall include factors which must be provided in: (1) any certification pursuant to section 401 of the Act, or (2) any permit application pursuant to section 402 of the Act. Such test procedures are to be used by permit applicants to demonstrate that effluent discharges meet applicable pollutant discharge limitations and by the States and other enforcement activities in routine or random monitoring of effluents to verify compliance with pollution control measures.

Interested persons were requested to submit written comments, suggestions, or objections to the proposed amendments by September 7, 1975. One hundred and thirty-five letters were received from commenters. The following categories of organizations were represented by the commenters: Federal agencies accounted for twenty-four responses; State agencies accounted for twenty-six responses; local agencies accounted for seventeen responses; regulated major dischargers accounted for forty-seven responses; trade and professional organizations accounted for eight responses; analytical instrument manufacturers and vendors accounted for seven responses; and analytical service laboratories accounted for six responses.

All comments were carefully evaluated by a technical review committee. Based upon the review of comments, the following principal changes to the proposed amendments were made:

(A) *Definitions.* Section 136.2 has been amended to update references: Twenty commenters, representing the entire spectrum of responding groups pointed out that the references cited in §§ 136.2 (f), 136.2(g), and 136.2(h) were out-of-date; §§ 136.2(f), 136.2(g), and 136.2(h), respectively, have been amended to show the following editions of the standard references: "14th Edition of Standard Methods for the Examination of Water and Waste Water;" "1974 EPA Manual of Methods for the Analysis of Water and Waste;" and "Part 31, 1975 Annual Book of ASTM Standards."

(B) *Identification of Test Procedures.* Both the content and format of § 136.3, "Table I, List of Approved Test Procedures" have been revised in response to twenty-one comments received from State and local governments, major regulated dischargers, professional and trade associations, and analytical laboratories.

Table I has been revised by:

(1) The addition of a fourth column of references which includes procedures of the United States Geological Survey which are equivalent to previously approved methods.

(2) The addition of a fifth column of miscellaneous references to procedures which are equivalent to previously approved methods.

(3) Listing generically related parameters alphabetically within four subcategories: bacteria, metals, radiological and residue, and by listing these subcategory headings in alphabetic sequence relative to the remaining parameters.

(4) Deleting the parameter "Algicides" and by entering the single relevant algicide, "Pentachlorophenol" by its chemical name.

(C) *Clarification of Test Parameters.* The conditions for analysis of several parameters have been more specifically defined as a result of comments received by the Agency:

(1) In response to five commenters, representing State or local governments, major dischargers, or analytical instrument manufacturers, the end-point for the alkalinity determination is specifically designated as pH 4.5.

(2) Manual digestion and distillation are still required as necessary preliminary steps for the Kjeldahl nitrogen procedure. Analysis after such distillation may be by Nessler color comparison, titration, electrode, or automated phenolate procedures.

(3) In response to eight commenters representative of Federal and State governments, major dischargers, and analytical instrument manufacturers, manual distillation at pH 9.5 is now specified for ammonia measurement.

(D) *New Parameters and Analytical Procedures.* Forty-four new parameters have been added to Table I. In addition to the designation of analytical procedures for these new parameters, the following modifications have been made in analytical procedures designated in response to comments.

(1) The ortho-tolidine procedure was not approved for the measurement of residual chlorine because of its poor accuracy and precision. Its approval had been requested by seven commenters representing major dischargers, State, or local governments, and analytical instrument manufacturers. Instead, the N,N-diethyl-p-phenylenediamine (DPD) method is approved as an interim procedure pending more intensive laboratory testing. It has many of the advantages of the ortho-tolidine procedure such as low cost, ease of operation, and also is of acceptable precision and accuracy.

(2) The Environmental Protection Agency concurred with the American Dye Manufacturers' request to approve its procedure for measurement of color, and copies of the procedure are now available at the Environmental Monitoring and Support Laboratory, Cincinnati (EMSL-CI)

(3) In response to three requests from Federal, State governments, and dischargers, "hardness," may be measured as the sum of calcium and magnesium analyzed by atomic absorption and expressed as their carbonates.

(4) The proposal to limit measurement of fecal coliform bacteria in the presence of chlorine to only the "Most Probable Number" (MPN) procedure has been withdrawn in response to requests from forty-five commenters including State pollution control agencies, permit holders, analysts, treatment plant operators, and a manufacturer of analytical supplies. The membrane filter (MF) procedure will continue to be an approved technique for the routine measurement of fecal coliform in the presence of chlorine. However, the MPN procedure must be used to resolve controversial situations. The technique selected by the analyst must be reported with the data.

(5) A total of fifteen objections, representing the entire spectrum of commenters, addressed the drying temperatures used for measurement of residues. The use of different temperatures in drying of total residue, dissolved residue and suspended residue was cited as not allowing direct intercomparability between these measurements. Because the intent of designating the three separate residue parameters is to measure separate waste characteristics (low drying temperatures to measure volatile substances, high drying temperatures to measure anhydrous inorganic substances), the difference in drying temperatures for these residue parameters must be preserved.

(E) *Deletion of Measurement Techniques.* Some measurement techniques that had been proposed have been deleted in response to objections raised during the public comment period.

(1) The proposed infrared spectrophotometric analysis for oil and grease has been withdrawn. Eleven commenters representing Federal or State agencies and major dischargers claimed that this parameter is defined by the measurement procedure. Any alteration in the procedure would change the definition of the parameter. The Environmental Protection Agency agreed.

(2) The proposed separate parameter for sulfide at concentrations below 1 mg/l, has been withdrawn. Methylene blue spectrophotometry is now included in Table I as an approved procedure for sulfide analysis. The titrimetric iodine procedure for sulfide analysis may only be used for analysis of sulfide at concentrations in excess of one milligram per liter.

(F) *Sample Preservation and Holding Times.* Criteria for sample preservation and sample holding times were requested by several commenters. The reference for sample preservation and holding time criteria applicable to the Table I parameters is given in footnote (1) of Table I.

(G) *Alternate Test Procedures.* Comments pertaining to § 136.4, Application for Alternate Test Procedures, included objections to various obstacles within

these procedures for expeditious approval of alternate test procedures. Four analytical instrument manufacturers commented that by limiting of application for review and/or approval of alternate test procedures to NPDES permit holders, § 136.4 became an impediment to the commercial development of new or improved measurement devices based on new measurement principles. Applications for such review and/or approval will now be accepted from any person. The intent of the alternate test procedure is to allow the use of measurement systems which are known to be equivalent to the approved test procedures in waste water discharges.

Applications for approval of alternate test procedures applicable to specific discharges will continue to be made only by NPDES permit holders, and approval of such applications will be made on a case-by-case basis by the Regional Administrator in whose Region the discharge is made.

Applications for approval of alternate test procedures which are intended for nationwide use can now be submitted by any person directly to the Director of the Environmental Monitoring and Support Laboratory in Cincinnati. Such applications should include a complete methods write-up, any literature references, comparability data between the proposed alternate test procedure and those already approved by the Administrator. The application should include precision and accuracy data of the proposed alternate test procedure and data confirming the general applicability of the test procedure to the industrial categories of waste water for which it is intended. The Director of the Environmental Monitoring and Support Laboratory, after review of submitted information, will recommend approval or rejection of the application to the Administrator, or he will return the application to the applicant for more information. Approval or rejection of applications for test procedures intended for nationwide use will be made by the Administrator, after considering the recommendation made by the Director of the Environmental Monitoring and Support Laboratory, Cincinnati. Since the Agency considers these procedures for approval of alternate test procedures for nationwide use to be interim procedures, we will welcome suggestions for criteria for approval of alternate test procedures for nationwide use. Interested persons should submit their written comments in triplicate on or before June 1, 1977 to: Dr. Robert B. Meds, Environmental Protection Technologist, Monitoring Quality Assurance Standardization, Office of Monitoring and Technical Support (RD-680), Environmental Protection Agency, Washington, D.C. 20460.

(H) *Freedom of Information.* A copy of all public comments, an analysis by parameter of those comments, and documents providing further information on the rationale for the changes made in the final regulation are available for inspection and copying at the Environmental Protection Agency Public Information Reference Unit, Room 2922, Waterside Mall, 401 M Street, SW., Washington, D.C. 20460, during normal business hours. The EPA information regulation 40 CFR 2 provides that a reasonable fee may be charged for copying such documents.

Effective date: These amendments become effective on April 1, 1977.

Dated: November 19, 1976.

JOHN QUARLES,
Acting Administrator,
Environmental Protection Agency.

Chapter I, Subchapter D, of Title 40, Code of Federal Regulations is amended as follows:

1. In § 136.2, paragraphs (f), (g), and (h) are amended to read as follows:

§ 136.2 Definitions.

* * * * *

(f) "Standard Methods" means *Standard Methods for the Examination of Water and Waste Water*, 14th Edition, 1976. This publication is available from the American Public Health Association, 1015 18th Street, N.W., Washington, D.C. 20036.

(g) "ASTM" means *Annual Book of Standards, Part 31, Water, 1975.* This publication is available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

(h) "EPA Methods" means *Methods for Chemical Analysis of Water and Waste, 1974.* Methods Development and Quality Assurance Research Laboratory, National Environmental Research Center, Cincinnati, Ohio 45268; U.S. Environmental Protection Agency, Office of Technology Transfer, Industrial Environmental Research Laboratory, Cincinnati, Ohio 45268. This publication is available from the Office of Technology Transfer.

2. In § 136.3, the second sentence of paragraph (b) is amended, and a new paragraph (c) is added to read as follows:

§ 136.3 Identification of test procedures.

* * * * *

(b) * * * Under such circumstances, additional test procedures for analysis of pollutants may be specified by the Regional Administrator or the Director upon the recommendation of the Director of the Environmental Monitoring and Support Laboratory, Cincinnati.

(c) Under certain circumstances, the Administrator may approve, upon recommendation by the Director, Environmental Monitoring and Support Laboratory, Cincinnati, additional alternate test procedures for nationwide use.

3. Table I of § 136.3 is revised by listing the parameters alphabetically by adding 44 new parameters; by adding a fourth column under references listing equivalent United States Geological Survey methods; by adding a fifth column under references listing miscellaneous equivalent methods; by deleting footnotes 1 through 7 and adding 24 new footnotes, to read as follows:

* * * * *

TABLE I.—*List of approved test procedures*[1]

Parameter and units	Method	1974 EPA methods	14th ed. standard methods	References (page nos.) Pt. 31 1975 ASTM	USGS methods [2]	Other approved methods
1. Acidity, as $CaCO_3$,[3] milligrams per liter.	Electrometric end point (pH of 8.2) or phenolphthalein end point.	1	278(44)	116	40	[4](607)
2. Alkalinity, as $CaCO_3$,[3] milligrams per liter.	Electrometric titration (only to pH 4.5) manual or automated, or equivalent automated methods.	3 5	276	111	41	[4](607)
3. Ammonia (as N), milligrams per liter.	Manual distillation [5] (at pH 9.5) followed by nesslerization, titration, electrode, Automated phenolate.	150 155 168	410 413 416	297	116	[4](614)
BACTERIA						
4. Coliform (fecal),[6] number per 100 ml.	MPN;[6] membrane filter.		922 927		[7](46)	
5. Coliform (fecal)[6] in presence of chlorine, number per 100 ml.	do.[6,8]		925 926, 927			
6. Coliform (total),[6] number per 100 ml.	do.[9]		916 920		[7](36)	
7. Coliform (total)[6] in presence of chlorine, number per 100 ml.	MPN;[6] membrane filter with enrichment.		917 923			
8. Fecal streptococci,[6] number per 100 ml.	MPN;[6] membrane filter; plate count.		943 944 947		[7](50)	
9. Benzidine, milligrams per liter.	Oxidation—colorimetric [5]					
10. Biochemical oxygen demand, 5-d (BOD_5), milligrams per liter.	Winkler (Azide modification) or electrode method.		543		[7](30)	[10](17)
11. Bromide, milligrams per liter.	Titrimetric, iodine-iodate	14		328	80	
12. Chemical oxygen demand (COD), milligrams per liter.	Dichromate reflux	20	550	472	154	[4](608) [10](17)
13. Chloride, milligrams per liter.	Silver nitrate; mercuric nitrate or automated colorimetric-ferricyanide.	20 21	305 306 315	237 305	[11](40)	[4](615)

See footnotes at end of table.

Parameter and units	Method	EPA methods	14th ed. standard methods	Reference (page nos.) Pt. 31 1975 ASTM	Reference (page nos.) USGS methods [1]	Other approved methods
14. Chlorinated organic compounds (except pesticides), milligrams per liter.	Gas chromatography [12]					
15. Chlorine—total residual, milligrams per liter.	Iodometric titration, amperometric or starch-iodine end-point; DPD colorimetric or Titrimetric methods (these last 2 are interim methods pending laboratory testing).	38	318 322 323 320	278		
16. Color, platinum cobalt units or dominant wave length, hue, luminance, purity.	Colorimetric; spectrophotometric; or ADMI procedure.[13]	25 30	64 66		82	
17. Cyanide, total,[14] milligrams per liter.	Distillation followed by silver nitrate titration or pyridine pyrazolone (or barbituric acid) colorimetric.	40	361	508	85	[15](22)
18. Cyanide amenable to chlorination, milligrams per liter.	do	40	376	505		
19. Dissolved oxygen, milligrams per liter.	Winkler (Azide modification) or electrode method.	51 58	443 450	503	126	[4](500)
20. Fluoride, milligrams per liter.	Distillation [4] followed by ion electrode; SPADNS; or automated complexone.	65 99 61	299 301 305 314	507 505	98	
21. Hardness—Total, as $CaCO_3$, milligrams per liter.	EDTA titration; automated colorimetric; or atomic absorption (sum of Ca and Mg as their respective carbonates).	66 70	303	161	94	[4](317)
22. Hydrogen ion (pH), pH units.	Electrometric measurement.	230	460	178	120	[4](508)
23. Kjeldahl nitrogen (as N), milligrams per liter.	Digestion and distillation followed by nesslerization, titration, or electrode; automated digestion automated phenolate.	175 145 182	437		122	[4](513)
METALS						
24. Aluminum—Total, milligrams per liter.	Digestion [16] followed by atomic absorption [17] or by colorimetric (Eriochrome Cyanine R).	93	162 171		[18] (19)	
25. Aluminum—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced methods for total aluminum.					
26. Antimony—Total, milligrams per liter.	Digestion [16] followed by atomic absorption.[20]	94				
27. Antimony—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total antimony.					
28. Arsenic—Total, milligrams per liter.	Digestion followed by silver diethyldithiocarbamate; or atomic absorption.[21] [22]	9 86	205 208 180		[23] (21) [24] (20)	
29. Arsenic—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total arsenic.					
30. Barium—Total, milligrams per liter.	Digestion [16] followed by atomic absorption.[25]	97	182		83	
31. Barium—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total barium.					
32. Beryllium—Total, milligrams per liter.	Digestion [16] followed by atomic absorption [17] or by colorimetric (Aluminon).	99	185 177		88	
33. Beryllium—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total beryllium.					
34. Boron—Total, milligrams per liter.	Colorimetric (Curcumin)	13	207			
35. Boron—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total boron.					
36. Cadmium—Total, milligrams per liter.	Digestion [16] followed by atomic absorption [17] or by colorimetric (Dithizone).	101	148 182	245	88 [4] (518) [26] (27)	
37. Cadmium—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total cadmium.					
38. Calcium—Total, milligrams per liter.	Digestion [16] followed by atomic absorption or EDTA titration.	100	142 139	246	85	
39. Calcium—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total calcium.					
40. Chromium VI, milligrams per liter.	Extraction and atomic absorption; colorimetric (Diphenylcarbazide).	86, 105	193		[27]73 73	
41. Chromium VI—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for chromium VI.					
42. Chromium—Total, milligrams per liter.	Digestion [16] followed by atomic absorption [17] or by colorimetric (Diphenylcarbazide).	105	148 148	245 250	73 77	[4](509)
43. Chromium—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total chromium.					

See footnotes at end of table.

Parameter and units	Method	EPA methods	14th ed. standard methods	References (page nos.) Pt. 31 1975 ASTM	USGS methods [1]	Other approved methods
44. Cobalt—Total, milligrams per liter.	Digestion [2] followed by atomic absorption.[16]	197	148	347	89	[3] (37)
45. Cobalt—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total cobalt.					
46. Copper—Total, milligrams per liter.	Digestion [2] followed by atomic absorption [16] or by colorimetric (Neocuproine).	203	148 196	345 350		[3] (319) [20] (37)
47. Copper—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total copper.					
48. Gold—Total, milligrams per liter.	Digestion [2] followed by atomic absorption.[16]					
49. Iridium—Total, milligrams per liter.	Digestion [2] followed by atomic absorption.[16]					
50. Iron—Total, milligrams per liter.	Digestion [2] followed by atomic absorption [16] or by colorimetric (Phenanthroline).	130	148 208	345 359	102	[3] (319)
51. Iron—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total iron.					
52. Lead—Total, milligrams per liter.	Digestion [2] followed by atomic absorption [16] or by colorimetric (Dithizone).	112	148 215	345	105	[3] (320)
53. Lead—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total lead.					
54. Magnesium—Total, milligrams per liter.	Digestion [2] followed by atomic absorption; or gravimetric.	134	148 201	345	109	[3] (319)
55. Magnesium—Dissolved milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total magnesium.					
56. Manganese—Total milligrams per liter.	Digestion [2] followed by atomic absorption [16] or by colorimetric (Persulfate or periodate).	135	148 208, 227	345	111	[3] (320)
57. Manganese—Dissolved milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total manganese.					
58. Mercury—Total, milligrams per liter.	Flameless atomic absorption.	118	126	339	[18] (51)	
59. Mercury—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total mercury.					
60. Molybdenum—Total, milligrams per liter.	Digestion [2] followed by atomic absorption.[16]	139		339		
61. Molybdenum—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total molybdenum.					
62. Nickel—Total, milligrams per liter.	Digestion [2] followed by atomic absorption [16] or by colorimetric (Heptoxime).	141	148	345	115	
63. Nickel—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total nickel.					
64. Osmium—Total, milligrams per liter.	Digestion [2] followed by atomic absorption.[16]					
65. Palladium—Total, milligrams per liter.	Digestion [2] followed by atomic absorption.[16]					
66. Platinum—Total, milligrams per liter.	Digestion [2] followed by atomic absorption.[16]					
67. Potassium—Total, milligrams per liter.	Digestion [2] followed by atomic absorption, colorimetric (Cobaltinitrite), or by flame photometric.	142	148 225	345	234	[3] (320)
68. Potassium—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total potassium.					
69. Rhodium—Total, milligrams per liter.	Digestion [2] followed by atomic absorption.[16]					
70. Ruthenium—Total, milligrams per liter.	Digestion [2] followed by atomic absorption.[16]					
71. Selenium—Total, milligrams per liter.	Digestion [2] followed by atomic absorption.[16] [19]	143	139			
72. Selenium—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total selenium.					
73. Silica—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by colorimetric (Molybdosilicate).	274	467	363	120	
74. Silver—Total,[21] milligrams per liter.	Digestion [2] followed by atomic absorption [16] or by colorimetric (Dithizone).	149	148 203		120	[3] (319) [20] (37)
75. Silver—Dissolved,[21] milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total silver.					
76. Sodium—Total, milligrams per liter.	Digestion [2] followed by atomic absorption or by flame photometric.	147	209	350	149	[3] (321)
77. Sodium—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total sodium.					

See footnotes at end of table.

Parameter and units	Method	1974 EPA methods	14th ed. standard methods	References (page nos.) Pt. 31 1975 ASTM	References (page nos.) USGS methods [1]	Other approved methods
78. Thallium—Total, milligrams per liter.	Digestion [16] followed by atomic absorption.[16]	140				
79. Thallium—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total thallium.					
80. Tin—Total, milligrams per liter.	Digestion [16] followed by atomic absorption.[16]	150			[11] (65)	
81. Tin—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total tin.					
82. Titanium—Total, milligrams per liter.	Digestion [16] followed by atomic absorption.[16]	151				
83. Titanium—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total titanium.					
84. Vanadium—Total, milligrams per liter.	Digestion [16] followed by atomic absorption [16] or by colorimetric (Gallic acid).	152	152 200	441	[11] (67)	
85. Vanadium—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total vanadium.					
86. Zinc—Total, milligrams per liter.	Digestion [16] followed by atomic absorption [16] or by colorimetric (Dithizone).	155	148 200	345	150	[3](619) [20](37)
87. Zinc—Dissolved, milligrams per liter.	0.45 micron filtration [17] followed by referenced method for total zinc.					
88. Nitrate (as N), milligrams per liter.	Cadmium reduction; brucine sulfate; automated cadmium or hydrazine reduction.[21]	201 197 207	423 427 430	338	119	[3](614) [20](38)
89. Nitrate (as N), milligrams per liter.	Manual or automated colorimetric (Diazotization).	215	434		121	
90. Oil and grease, milligrams per liter.	Liquid-liquid extraction with trichloro-trifluoroethane-gravimetric.	220	515			
91. Organic carbon; total (TOC), milligrams per liter.	Combustion—Infrared method.[22]	224	532	467	[23] (4)	
92. Organic nitrogen (as N), milligrams per liter.	Kjeldahl nitrogen minus ammonia nitrogen.	175, 150	437		122	[3] (612, 614)
93. Orthophosphate (as P), milligrams per liter.	Manual or automated ascorbic acid reduction.	249 256	681 684	394	131	[3] (621)
94. Pentachlorophenol, milligrams per liter.	Gas chromatography [24]					
95. Pesticides, milligrams per liter.	do.[24]		555	359	[25] (24)	
96. Phenols, milligrams per liter.	Colorimetric, (4AAP)	261	557	548		
97. Phosphorus (elemental), milligrams per liter.	Gas chromatography [26]					
98. Phosphorus; total (as P), milligrams per liter.	Persulfate digestion followed by manual or automated ascorbic acid reduction.	249 256	676, 681 684	394	129	[3] (621)
RADIOLOGICAL						
99. Alpha—Total, pCi per liter.	Proportional or scintillation counter.		648	361 [27] [28] (75+76)		
100. Alpha—Counting error, pCi per liter.	do.		648	394	[29] (79)	
101. Beta—Total, pCi per liter.	Proportional counter		648	361 [27] [28] (75+76)		
102. Beta—Counting error, pCi per liter.	do.		648	405	[29] (79)	
103. (a) Radium—Total, pCi per liter.	do.		661	661		
(b) ^{226}Ra, pCi per liter.	Scintillation counter		667		[29] (31)	
RESIDUE						
104. Total, milligrams per liter	Gravimetric, 103 to 105° C.	270		91		
105. Total dissolved (filterable), milligrams per liter.	Glass fiber filtration, 180° C.	260		92		
106. Total suspended (nonfilterable), milligrams per liter.	Glass fiber filtration, 103 to 105° C.	269		94		
107. Settleable, milliliters per liter or milligrams per liter.	Volumetric or gravimetric			95		
108. Total volatile, milligrams per liter.	Gravimetric, 550° C.	272		95		
109. Specific conductance, micromhos per centimeter at 25° C.	Wheatstone bridge conductimetry.	275	71	120	148	[3] (606)
110. Sulfate (as SO_4), milligrams per liter.	Gravimetric; turbidimetric; or automated colorimetric (barium chloranilate).	277 277 279	486 488	434 435		[3] (624) [3] (625)
111. Sulfide (as S), milligrams per liter.	Titrimetric—Iodine for levels greater than 1 mg per liter; Methylene blue photometric.	284	505 508		134	
112. Sulfite (as SO_3), milligrams per liter.	Titrimetric, Iodine-Iodate	286	508	435		
113. Surfactants, milligrams per liter.	Colorimetric (Methylene blue).	287	600	494	[30] (11)	
114. Temperature, degrees C.	Calibrated glass or electrometric thermometer.	288	126		[30] (31)	
115. Turbidity, NTU.	Nephelometric	290	122	388	136	

[1] Recommendations for sampling and preservation of samples according to parameter measured may be found in "Methods for Chemical Analysis of Water and Wastes, 1974" U.S. Environmental Protection Agency, table 2, pp. viii-xii.

[9] All page references for USGS methods, unless otherwise noted, are to Brown, E., Skougstad, M. W., and Fishman, M. J., "Methods for Collection and Analysis of Water Samples for Dissolved Minerals and Gases," U.S. Geological Survey Techniques of Water-Resources Inv., book 5, ch. A1, (1970).

[3] EPA comparable method may be found on indicated page of "Official Methods of Analysis of the Association of Official Analytical Chemists" methods manual, 12th ed. (1975).

[4] Manual distillation is not required if comparability data on representative effluent samples are on company file to show that this preliminary distillation step is not necessary; however, manual distillation will be required to resolve any controversies.

[5] The method used must be specified.

[6] The 5 tube MPN is used.

[7] Slack, K. V. and others, "Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples: U.S. Geological Survey Techniques of Water-Resources Inv. book 5, ch. A4 (1973)."

[8] Since the membrane filter technique usually yields low and variable recovery from chlorinated wastewaters, the MPN method will be required to resolve any controversies.

[9] Adequately tested methods for benzidine are not available. Until approved methods are available, the following interim method can be used for the estimation of benzidine: (1) "Method for Benzidine and Its Salts in Wastewaters," available from Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268.

[10] American National Standard on Photographic Processing Effluents, Apr. 2, 1975. Available from ANSI, 1430 Broadway, New York, N.Y. 10018.

[11] Fishman, M. J. and Brown, Eugene, "Selected Methods of the U.S. Geological Survey for Analysis of Wastewaters," (1976) open-file report 76-177.

[12] Procedures for pentachlorophenol, chlorinated organic compounds ,and pesticides can be obtained from the Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268.

[13] Color method (ADMI procedure) available from Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268.

[14] For samples suspected of having thiocyanate interference, magnesium chloride is used as the digestion catalyst. In the approved test procedure for cyanides, the recommended catalysis are replaced with 20 ml of a solution of 510 g/l magnesium chloride ($MgCl_2 \cdot 6H_2O$). This substitution will eliminate thiocyanate interference for both total cyanide and cyanide amenable to chlorination measurements.

[15] For the determination of total metals the sample is not filtered before processing. Because vigorous digestion procedures may result in a loss of certain metals through precipitation, a less vigorous treatment is recommended as given on p. 83 (4.1.4) of "Methods for Chemical Analysis of Water and Wastes" (1974). In those instances where a more vigorous digestion is desired the procedure on p. 83 (4.1.5) should be followed. For the measurement of the noble metal series (gold, iridium, osmium, palladium, platinum, rhodium and ruthenium), an aqua regia digestion is to be substituted as follows: Transfer a representitive aliquot of the well-mixed sample to a Griffin beaker and add 3 ml of concentrated redistilled HNO_3. Place the beaker on a steam bath and evaporate to dryness. Cool the beaker and cautiously add a 5 ml portion of aqua regia. (Aqua regia is prepared immediately before use by carefully adding 3 volumes of concentrated HCl to one volume of concentrated HNO_3.) Cover the beaker with a watch glass and return to the steam bath. Continue heating the covered beaker for 30 min. Remove cover and evaporate to dryness. Cool and take up the residue in a small quantity of 1:1 HCl. Wash down the beaker walls and watch glass with distilled water and filter the sample to remove silicates and other insoluble material that could clog the atomiser. Adjust the volume to some predetermined value based on the expected metal concentration. The sample is now ready for analysis.

[16] As the various furnace devices (flameless AA) are essentially atomic absorption techniques, they are considered to be approved test methods. Methods of standard addition are to be followed as noted in p. 78 of "Methods for Chemical Analysis of Water and Wastes," 1974.

[17] Dissolved metals are defined as those constituents which will pass though a 0.45 μm membrane filter. A prefiltration is permissible to free the sample from larger suspended solids. Filter the sample as soon as practical after collection using the first 50 to 100 ml to rinse the filter flask. (Glass or plastic filtering apparatus are recommended to avoid possible contamination.) Discard the portion used to rinse the flask and collect the required volume of filtrate. Acidify the filtrate with 1:1 redistilled HNO_3 to a pH of 2. Normally, 3 ml of (1:1) acid per liter should be sufficient to preserve the samples.

[18] See "Atomic Absorption Newsletter," vol. 13, 75 (1974). Available from Perkin-Elmer Corp., Main Ave., Norwalk, Conn. 06852.

[19] Method available from Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268.

[20] Recommended methods for the analysis of silver in industrial wastewaters at concentrations of 1 mg/l and above are inadequate where silver exists as an inorganic halide. Silver halides such as the bromide and chloride are relatively insoluble in reagents such as nitric acid but are readily soluble in an aqueous buffer of sodium thiosulfate and sodium hydroxide to a pH of 12. Therefore, for levels of silver above 1 mg/l 50 ml sample should be diluted to 100 ml by adding 40 ml each of 2M $Na_2S_2O_3$ and 2M NaOH. Standards should be prepared in the same manner. For levels of silver below 1 mg/l the recommended method is satisfactory.

[21] An automated hydrazine reduction method is available from the Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268.

[22] A number of such systems manufactured by various companies are considered to be comparable in their performance. In addition, another technique, based on combustion-methane detection is also acceptable.

[23] Goerlitz, D., Brown, E., "Methods for Analysis of Organic Substances in Water": U.S. Geological Survey Techniques of Water-Resources Inv., book 5, ch. A3 (1972).

[24] R. F. Addison and R. G. Ackman, "Direct Determination of Elemental Phosphorus by Gas-Liquid Chromatography," "Journal of Chromatography," vol. 47, No. 3, pp. 421-426, 1970.

[25] The method found on p. 78 measures only the dissolved portion while the method on p. 78 measures only suspended. Therefore, the results must be added together to obtain "total."

[26] Stevens, H. H., Ficke, J. F., and Smoot, G. F., "Water Temperature—Influential Factors, Field Measurement and Data Presentation," Geological Survey Techniques of Water Resources Inv., book 1 (1975)."

4. In § 136.4, the second sentence of paragraph (c) is amended by deleting the word "subchapter" immediately following the phrase "procedure under this" and immediately preceding the word "shall" and replaced with the phrase "paragraph c;" and § 136.4 is amended by adding a new paragraph (d) to read as follows:

§ 136.4 Application for alternate test procedures.

* * * * * *

(c) * * * Any application for an alternate test procedure under this paragraph (c) shall: * * *

(d) An application for approval of an alternate test procedure for nationwide use may be made by letter in triplicate to the Director, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268. Any application for an alternate test procedure under this paragraph (d) shall:

(1) Provide the name and address of the responsible person or firm making the application.

(2) Identify the pollutant(s) or parameter(s) for which nationwide approval of an alternate testing procedure is being requested.

(3) Provide a detailed description of the proposed alternate procedure, together with references to published or other studies confirming the general applicability of the alternate test procedure to the pollutant(s) or parameter(s) in waste water discharges from representative and specified industrial or other categories.

(4) Provide comparability data for the performance of the proposed alternate test procedure compared to the performance of the approved test procedures.

§ 136.5 [Amended]

5. In § 136.5, paragraph (a) is amended by inserting the phrase "proposed by the responsible person or firm making the discharge" immediately after the words "test procedure" and before the period that ends the paragraph.

6. In § 136.5, paragraph (b) is amended by inserting in the first sentence the phrase "proposed by the responsible person or firm making the discharge" immediately after the words "such application" and immediately before the comma. The second sentence of paragraph (b) is amended by deleting the phrase "Methods Development and Quality Assurance Research Laboratory" immediately after the phrase "State Permit Program and to the Director of the" at the end of the sentence, and inserting in its place the phrase "Environmental Monitoring and Support Laboratory, Cincinnati."

7. In § 136.5, paragraph (c) is amended by inserting the phrase "proposed by the responsible person or firm making the discharge" immediately after the phrase "application for an alternate test procedure" and immediately before the comma; and by deleting the phrase "Methods Development and Quality Assurance Laboratory" immediately after the phrase "application to the Director of the" and immediately before the phrase "for review and recommendation" and inserting in its place the phrase "Environmental Monitoring and Support Laboratory, Cincinnati."

8. In § 136.5, the first sentence of paragraph (d) is amended by inserting the phrase, "proposed by the responsible person or firm making the discharge," immediately after the phrase, "application for an alternate test procedure," and immediately before the comma.

The second sentence of paragraph (d) is amended by deleting the phrase, "Methods Development and Quality Assurance Research Laboratory," immediately after the phrase, "to the Regional Administrator by the Director of the," and immediately preceding the period ending the sentence and inserting in its place the phrase, "Environmental Monitoring and Support Laboratory, Cincinnati."

The third sentence of paragraph (d) is amended by deleting the phrase, "Methods Development and Quality Assurance Research Laboratory," immediately after the phrase, "forwarded to the Director," and immediately before the second comma and by inserting in its place the phrase, "Environmental Monitoring and Support Laboratory, Cincinnati."

9. Section 136.5 is amended by the addition of a new paragraph (e) to read as follows:

§ 136.5 Approval of alternate test procedures.

* * * * *

(e) Within ninety days of the receipt by the Director of the Environmental Monitoring and Support Laboratory, Cincinnati of an application for an alternate test procedure for nationwide use, the Director of the Environmental Monitoring and Support Laboratory, Cincinnati shall notify the applicant of his recommendation to the Administrator to approve or reject the application, or shall specify additional information which is required to determine whether to approve the proposed test procedure. After such notification, an alternate method determined by the Administrator to satisfy the applicable requirements of this part shall be approved for nationwide use to satisfy the requirements of this subchapter; alternate test procedures determined by the Administrator not to meet the applicable requirements of this part shall be rejected. Notice of these determinations shall be submitted for publication in the FEDERAL REGISTER not later than 15 days after such notification and determination is made.

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2. Announcing the Course

a. Course Availability

Course availability is most likely to be established through one of two mechanisms:

1) Management or regulatory authority determines that training is required, makes arrangements for course presentation and instructs designated personnel to appear at a specified time and place for training; or,

2) The course may be planned by a training organization which schedules and publicly announces the course either as a special offering or as an element of an overall curriculum of training.

b. Responsibility for Course Announcement

All training organizations should establish and maintain mailing lists of officials, organizations and interested individuals to whom training announcements should be addressed.

Course announcements should be released by the training organization and/or the sponsoring agency (if applicable).

When a special course offering is planned at the request of management or regulatory authority with identified class participants, it usually is best for the requesting authority to make the announcement.

c. Types of Course Announcements

1) Training bulletins, or catalogues are widely used by established training organizations, and should be used for announcement of this course when offered as part of an on-going curriculum of courses.

2) Special fliers or brochures should be developed for public announcement through established mailing lists. These releases may be used for regular offerings of an on-going curriculum of courses; but they are particularly applicable when a special offering of the course is planned.

3) The course may be announced in a journal, newsletter or other periodical widely read by the personnel for whom the training is intended.

4) The course may be announced by personal letter or other direct communication with a student assigned to take the training.

d. Timing of Course Announcements

Training catalogues or bulletins usually are for a period of one year or more. Accordingly, the prospective student should have from three months to one year of advance notice of the training.

When the course is a special offering announced through a flier or other special mechanism, at least 90 days should be provided between the release of the announcement and the start of the course. There are at least two reasons for this:

1) Permits course applicants to secure necessary approvals for attendance, and to make personal scheduling arrangements; and,

2) Provides course presentation staff with lead time for course preparations, acquiring special instructional materials, preparation of laboratory supplies and equipment, and related tasks.

e. Information Provided in Course Announcements

The following list should be helpful as a checklist to those preparing a course announcement. Samples of an announcement for this course as it might appear in a catalogue of courses, and as it might appear in a special flier are shown in the section of this Guide titled SECRETARIAL SUPPORT.

In the event that the course is announced in a periodical, the editor may apply constraints on style and format which make it impossible to provide all the pertinent information on the course. In such cases the announcement must provide the name and address of an office from which further information can be obtained. The information to be provided should be as complete as that given in a course catalogue or flier and, naturally, should include any additional special information specifically requested.

The following will be helpful as a checklist to those preparing an original course announcement:

1) Course title, dates and location

2) Name of organization conducting the course (and name of co-sponsor, if applicable)

3) Description of intended student body, reason why this training is needed and summary of Course content.

4) Prerequisites for attendance (special skills or training which the applicant must have for admission)

5) Description of the training environment to be used (classroom, laboratory, field, in-plant, etc.)

6) Identification of knowledge and skills the participant will have on satisfactory completion of training

7) Tuition (if applicable)

8) How and where to apply for admission to this course

3. Summary Plan for the Course

A convenient format to use in the early stages of devising a course plan is a day-to-day assignment of time blocks based on estimates by authors of the training time required for each parameter. (An example is on the next page.) Using available time as a first criterion will allow a variety of possible sequences. .Then other considerations should be applied. Some examples are:

a. If some equipment must be used in more than one test, schedule another topic between the two tests to allow time for the required clean-up.

b. Schedule the topics so each instructor alternates between prime and assistant responsibilities to allow time for preparations which must be done right before training sessions.

c. If one procedure requires skills taught in another procedure, order the presentations accordingly.

d. If most students need only 80% of the procedures taught, schedule the remaining 20% of the procedures as a group so students can conveniently schedule their attendance for training pertinent to their needs.

EFFLUENT MONITORING PROCEDURES: METALS ANALYSIS

SUMMARY PLAN FOR COURSE

MONDAY		TUESDAY		WEDNESDAY		THURSDAY		FRIDAY	
Activity	Time Hours	Activity	Time Hours	Activity	Time Hours	Activity	Time Hours	Activity	Time Hours
Registration Course Coordinator	1/2	Laboratory Colorimetric Analysis-Boron Volumetric Determination of Calcium AA Determination of Pb Flameless Hg Flame Photometric Determination of K & Na AA Determination of Cu++ Mg++, Mn++, & Zn++ Chemists	7	Laboratory Colorimetric Analysis-Boron Volumetric Determination of Calcium AA Determination of Pb Flameless Hg Flame Photometric Determination of K & Na AA Determination of Cu++ Mg++, Mn++ & Zn++ Chemists	7	Laboratory Colorimetric Analysis-Boron Volumetric Determination of Calcium AA Determination of Pb Flameless Hg Flame Photometric Determination of K&Na AA Determination of Cu^{++} Mg^{++}, Mn^{++}, & Zn^{++} Chemists	7	Planning & Conducting 164.2 - Discussion of EMPs & IPWs Boron EMP Flameless Hg EMP Flame Photometry EMP Volumetric Ca EMP AA Pb EMP AA Metals EMP All Staff	1 1/2
Course Objectives & Organization Course Coordinator	1/4							Panel Discussion - Instrumentation Trouble Shooting & Maintenance Chemists	3/4
Introduction to Atomic Absorption Chemist	3/4							Reporting Results Engineer	1
Absorption Spectroscopy Chemist	3/4							Course Evaluation & Closing All Staff	1/2
Principles of Flame Photometry Chemist	3/4								
Volumetric Metal Analysis Chemists	3/4								
Laboratory - Preparation of Standard Solutions Chemists	3 1/2								

NOTES: 1. Class is divided into three sections of two groups each so that each individual will utilize three and one-half hours for each of the six laboratory exercises respectively.

2. Program time only is shown. Additional time required for lunch and breaks.

3. Leading instructor only is designated. Other instructors will provide support to leading instructors for all laboratory instruction.

EFFLUENT MONITORING PROCEDURES: METALS ANALYSES (164.2T)

(LOCATION)

(DATE)

AGENDA

Course Coordinator:

DAY AND TIME	SUBJECT	SPEAKER
Monday		
8:00 - 8:30	Registration Welcome	Course Coordinator
8:30 - 8:45	Course Objectives	Course Coordinator
8:45 - 9:30	Introduction to Atomic Absorption	Chemist
9:30 - 9:45	Break	
9:45 - 10:30	Absorption Spectroscopy	Chemist
10:30 - 11:15	Principles of Flame Photometry	Chemist
11:15 - 12:00	Volumetric Metal Analysis	Chemist
12:00 - 1:00	Lunch	
1:00 - 4:30	LABORATORY - PREPARATION OF STANDARD SOLUTIONS	
1:00 - 1:45	Colorimetric Analysis - Boron Standards	Chemist
1:45 - 2:30	Volumetric Determination -	Chemist
2:30 - 2:45	Break	
2:45 - 3:30	Atomic Absorption Standards	Chemist
3:30 - 4:00	Flame Photometric Standards	Chemist
4:00 - 4:30	Discussion	Staff
Tuesday		
8:30 - 12:00	LABORATORY	
	Section I Group A Colorimetric Analysis - Boron	Chemist
	Group B Volumetric Determination of Calcium	Chemist

AGENDA

DAY AND TIME	SUBJECT	SPEAKER
Tuesday		
8:30 - 12:00	Section II	
	Group A	
	AA Determination of Pb	Chemist
	Group B	
	Flameless Hg	Chemist
	Section III	
	Group A	
	Flame Photometric Determination of K and Na	Chemist
	Group B	
	AA Determination of CU^{++}, Mg^{++}, Mn^{++}, and Zn^{++}	Chemist
12:00 - 1:00	Lunch	
1:00 - 4:30	LABORATORY	
	Section I	
	Group A	
	AA Determination of Pb	Chemist
	Group B	
	Flameless Hg	Chemist
	Section II	
	Group A	
	Flame Photometric Determination of K & Na	Chemist
	Group B	
	AA Determination of Cu^{++}, Mg^{++}, Mn^{++}, and Zn^{++}	Chemist
	Section III	
	Group A	
	Colorimetric Analysis - Boron	Chemist
	Group B	
	Volumetric Determination of Calcium	Chemist
Wednesday		
8:30 - 12:00	LABORATORY	
	Section I	
	Group A	
	Flame Photometric Determination of K and Na	Chemist
	Group B	
	AA Determination of Cu^{++}, Mg^{++}, Mn^{++}, and Zn^{++}	Chemist

AGENDA

DAY AND TIME	SUBJECT	SPEAKER
Wednesday		
	Section II Group A Colorimetric Analysis - Boron	Chemist
	Group B Volumetric Determination of Calcium	Chemist
	Section III Group A AA Determination of Pb	Chemist
	Group B AA - Flameless Hg	Chemist
12:00 - 1:00	Lunch	
1:00 - 4:30	LABORATORY	
	Section I Group A Volumetric Determination of Calcium	Chemist
	Group B Colorimetric Analysis - Boron	Chemist
	Section II Group A Flameless Hg	Chemist
	Group B AA Determination of Pb	Chemist
	Section III Group A AA Determination of Cu^{++}, Mg^{++}, Mn^{++}, and Zn^{++}	Chemist
	Group B Flame Photometric Determination of K and Na	Chemist
Thursday		
8:30 - 12:00	LABORATORY	
	Section I Group A Flameless Hg	Chemist
	Group B AA Determination of Pb	Chemist
	Section II Group A AA Determination of Cu^{++}, Mg^{++}, Mn^{++}, and Zn^{++}	Chemist

AGENDA

DAY AND TIME	SUBJECT	SPEAKER
Thursday		
	Group B Flame Photometric Determination of K and Na	Chemist
	Section III Group A Volumetric Determination of Calcium	Chemist
	Group B Colorimetric Analysis - Boron	Chemist
12:00 - 1:00	Lunch	
1:00 - 4:30	LABORATORY	
	Section I Group A AA Determination of Cu^{++}, Mg^{++}, Mn^{++}, and Zn^{++}	Chemist
	Group B Flame Photometric Determination of K and Na	Chemist
	Section II Group A Volumetric Determination of Calcium	Chemist
	Group B Colorimetric Analysis - Boron	Chemist
	Section III Group A Flameless Hg	Chemist
	Group B AA Determination of Pb	Chemist
Friday		
8:30 - 10:00	Planning and Conducting 164.2 Discussion of EMPs and IPWs	
8:30 - 8:45	Boron EMP	Chemist
8:45 - 9:00	Flameless Hg EMP	Chemist
9:00 - 9:15	Flame Photometry EMP	Chemist
9:15 - 9:30	Volumetric Ca EMP	Chemist
9:30 - 9:45	AA Pb EMP	Chemist
9:45 - 10:00	AA Metals EMP	Chemist

AGENDA

DAY AND TIME	SUBJECT	SPEAKER
Friday		
10:00 - 10:15	Break	
10:15 - 11:00	Panel Discussion - Instrumentation Trouble Shooting and Maintenance	Staff
11:00 - 12:00	Reporting Results	Sanitary Engineer
12:00 - 12:30	Course Evaluation and Closing	Course Coordinator

Course Milestones (164.2)

The following pages list individual responsibilities in a chronological order for preparation for this course.

The individual EMPs listed in the accompanying course manual and professional level of competence required for the principal instructor is shown in Table I.

Code	Description	Title
CH.MET.as.EMP.1a.1.76	Determination of Boron, Curcumin Method	Chemist
CH.ca.EMP.1.1.76	Determination of Total Calcium (Volumetric Method)	Chemist
CH.MET.aa.EMP.1a.1.76	Determination of Copper (Cu^{++}), Magnesium (Mg^{++}), Manganese (Mn^{++}), and (Zn^{++})	Chemist
CH.MET.aa.EMP.2a.1.76	Determination of Lead By Atomic Absorption Using the Extraction Procedure	Chemist
CH.MET.aa.EMP.3a.1.76	Determination of Mercury Using the Flameless Atomic Absorption (Cold Vapor) Technique	Chemist
CH.MET.es.EMP.2a.1.76	Determination of Potassium Using Flame Photometry	Chemist
CH.MET.es.EMP.1a.1.76	Determination of Sodium Using Flame Photometry	Chemist

	Training Supervisor	Course Director	Course Secretary	Chemist	Outline No. and Remarks
5 to 6 months before Course					
Determination of the need and decision to have course.	x				
Designation of Course Director and Course Secretary.	x				
Development and release of Course Announcement including location, date, general statement of course content and training objectives.		x	x		
Course Registrations received and accepted from time of announcement to first day of course, subject to class size limitations.		x	x		Director reviews application form and forwards to secretary for appropriate action.
3 Months before Course					
Review equipment and supplies list for items which may be purchased or borrowed.		x	x	x	Professional staff initiates requests through director.
Commit all staff personnel who will participate in course.	x	x	x	x	First assignment will be equipment and supplies review.
Inventory stock of course manual.		x			Supplies should be adequate for each trainee and staff member.
2 Months before Course					
Request equipment and supplies from lending organizations (analytical instrumentation, audiovisual training aids, audiovisual support equipment,etc)		x	x	x	Professional staff initiates requests through director. Should be received at least one week before course and checked when received.

	Training Supervisor	Course Director	Course Secretary	Chemist	Outline No. and Remarks
3 Weeks before Course					
Prepare Glassware, all reusable and consumable supplies.				x	All EMPs
Capital equipment operational check.				x	All EMPs
2 Weeks before Course					
Inventory availability of all reusable and consumable materials and supplies.				x	All EMPs
1 Week before Course					
Final checkout of all analytical instrumentation.				x	All EMPs

PART I - COURSE PLANNING AND MANAGEMENT

B. Training Resources

This section considers four topics: Training Staff, Training Facilities, Laboratory Equipment and Supply Requirements, and Instructional Resources.

Staffing plans, facilities, equipment and supplies described in this Guide are based on a class of 18 students. For at least the first several (3 or 4) course offerings, it is urged that this maximum number of students per class be strictly adhered to.

A staff experienced in presentation of this course may be able to increase class size to, say, 24 students. On no account should this laboratory-oriented course exceed 24 students with an instructional staff of the size described here. Large numbers of students per instructor simply cannot be provided with the individual attention and instruction required for effective training and assurance that they have indeed learned to perform the analyses which are the subject of this course.

If the number of workers requiring this course is quite large, the best course of action is to meet the training need through providing a greater number of course offerings.

The required instructional resources, shown in outline 9, are compiled from the individual instructional package worksheets shown in Part II. Training administrators should coordinate requests for instructional resources to be acquired, through loan or through purchase, from other sources. This outline provides a basis for such coordination.

1. Training Staff

Each member of the training staff for this, as for any short course, is a member of a team. This team can function effectively only through each member's understanding of the training goals to be met and the plans for meeting these goals, through performance of his/her own duties, and through providing mutually supportive activity with other team members for the effective conduct of the course as a whole.

a. Qualifications of Instructional Staff

1) Each should have a thorough knowledge of the subject matter for which he/she has responsibility, including a high order of technical skill in any procedures to be carried out.

2) Each should be able to perform effectively as an instructor, both in the classroom and in the laboratory. This includes ability to make rapid adjustments in the style and technical level of instruction in order to work with students having a varied range of entry-level knowledge, skills, and prior education.

3) Each should be willing to accept a certain rigidity in the choice of analytical procedures to be taught, in accordance with policies

and formal directives of the applicable regulatory authority (-ies). The basis for, and recommended procedures to be followed, in introducing variations in methods to be taught in tests and measurements of municipal effluents is discussed elsewhere in this Guide.

b. Estimated Time Allocations for Training Staff

Each member of the training staff has specific duties before, during, and after the scheduled course dates. For planning purposes, it is assumed that pre-course activity will begin three months or more, as required, before classroom instruction begins. During this period, the estimated time allocations will permit the phasing-in of work activity for this course with other duties of all personnel. During the course, all instructional staff and laboratory assistant (if used) are fully occupied, and should not be given any other duty assignments. Post-course activities should be completed within one or two weeks after the last day of instruction. In the post-course period, all staff may begin to phase in other duties pending final completion of all details associated with this training effort.

Staff Identification	Working Days (estimate)		
	Before	During	After
Course Administration			
Course Coordinator (ordinarily, this is one of the instructional staff, who is assigned double-duty as coordinator-instructor)	12	1	2
Course Secretary	10	2	2
Instructional Staff			
Chemist #1	8	5	2
Chemist #2	8	5	2
Chemist #3	8	5	2
Chemist #4	8	5	2
Chemist #5	8	5	2
Chemist #6	8	5	2
Laboratory Support			
Laboratory Assistant (optional)	10	5	5

c. Duties and Responsibilities of Training Staff

1) Course Coordinator

This individual may be known variously as Course Director, Course Leader, or by some other term suitable to the situation. In most cases the Course Coordinator will function in a dual capacity as one

of the instructional staff for the course. In principle, any one of the Instructors could function as Course Coordinator. In the absence of other factors, it may be best to have the individual who bears the lightest teaching load to act as Course Coordinator.

a) Before the course, the Coordinator receives assignment from management to lead the course, after which he/she:

(1) Obtains commitment of the other members of the training team for the course, including Secretary, Instructors, and (if used) Laboratory Assistant;

(2) Determines the composition and geographic origin of the student body to be trained;

(3) Develops a working schedule and specific staff assignments for all significant milestone stages of course preparation and implementation;

(4) Meets with course staff, distributes instructional guides and related training materials, and reviews the preparation plans and day-to-day working schedule; assigns specific topics and time allocation for which each Instructor has prime instructional responsibility and for which each Instructor serves as assistant to prime Instructor;

(5) Identifies which, if any, available options in procedures should be taught for compliance with directives of the governing regulatory authority (-ies);

(6) Prepares announcement of the course, and distributes it as appropriate to the potential student body;

(7) Reviews classroom and laboratory facilities, making arrangements for any required repairs or adaptations;

(8) In consultation with Instructors, reviews availability and condition of all equipment, supplies, and other training resources required for the course, and makes timely arrangements for repair and maintenance, reorder, or borrowing of needed items;

(9) Arranges for supplies of student reference texts and associated training materials;

(10) Works with Secretary in registration of students and in all pre-course communications on schedules, local housing and transportation, and other pertinent matters;

(11) If the course is to be conducted in a "field" location, coordinates timely arrangements for staff travel, transportation of equipment and supplies, arrangements for training facilities, local housing and transportation, determination of availability and location of dining facilities, and any other preparations required for course conduct away from normal base location;

(12) Initiates periodic and timely checks with other training team members to assure that their pre-course preparations are on schedule and that preparation of required resources is moving ahead according to plan. Takes action as necessary to identify problems and to expedite solutions as the need arises;

(13) Represents the training team in all formal communications with management, host organizations, students, and with commercial or private sources of equipment and supplies.

b) During the course, the Course Coordinator:

(1) Takes charge of course opening exercises including student registration, welcome and staff introductions. Presents and discusses course objectives;

(2) Maintains general supervision of course, assuring that all activities are kept on schedule; maintains liaison between staff members and other interfacing organizations/ individuals as necessary;

(3) Maintains consolidated summary record of student performance based on information provided by other Instructors; with staff determines which students should/should not be recorded as having satisfactorily met training objectives;

(4) Provides Course Secretary with timely information necessary for preparation of course certificates; signs course certificates as representative of the course training staff;

(5) Presides over course closing activities, including award of certificates.

c) After the course, the Course Coordinator:

(1) Reviews and evaluates with the instructional staff all matters considered pertinent to the effective implementation of the course as planned, developing proposals and plans for adjustments as necessary for future offerings of the course;

(2) Orders repair, renovation, and replacement of any equipment or supplies that require such attention;

(3) Coordinates return of any borrowed resources used in the course;

(4) If course was conducted in the field, coordinates repacking and return shipment of all equipment and supplies;

(5) Drafts course summary/evaluation report;

(6) Prepares and forwards any reports required by other supervising, coordinating, or financing authority.

2) Course Secretary

The Course Secretary works under the direct supervision of the Course Coordinator, and prepares or arranges preparation of all formal communications, procurement documents, training materials, and records required for course preparation and implementation. The Course Secretary also provides office support work for the course instructional staff in all matters pertaining to course preparation and implementation.

a) Before the course, the Course Secretary:

(1) Works with the Course Coordinator in identification and preparation of copies of all pertinent course materials for use in planning conferences between Course Coordinator and the instructional staff, including Instructors' copies of working schedules for course preparation, course agenda from preliminary to final draft, staff assignments, Instructors' instructional package worksheets, all student instructional materials and associated data sheets, student evaluation sheets, quizzes, and any other typed or printed material projected for course use;

(2) After Course Coordinator's conference with instructional staff, and resolution of decision making issues, arranges for printing (or reproduction) and assembly of all materials indicated under (1) above, in a quantity adequate for projected course requirements;

(3) Arranges for printing or reproduction, and distribution of the projected course announcement as directed by Course Coordinator;

(4) Serves as Registrar, maintaining roster and records of students submitting application and accepted for admission to the course, prepares routine response to students announcing acceptance with information as appropriate on course dates and schedule, local "geography" including key addresses, hotel/motel/dining information, local transportation information, and any other information which will simplify personal planning of registered students;

(5) Prepares, or arranges for, all individual student supplies, including registration cards, course manuals, note paper, pencils, name tags (1 for wearing and 1 for use at classroom seating position), course certificates, etc.;

(6) Prepares orders or procurement requests for equipment and supplies needed for the course based on specifications provided by the instructional staff;

(7) If the course is a "field" presentation, makes arrangements for shipment of equipment and supplies to course site and return, staff travel schedules and order of tickets, hotel reservations, and associated functions;

(8) Prepares the classroom for use in the course, including distribution of individual student materials to seating positions, arrangements for classroom organization of audiovisual projection or playback equipment, chalkboards and associated supplies, and other classroom needs. (Ordinarily, the Course Secretary does not travel to a "field" presentation; this function will have to be provided through special arrangements with the host organization at the course site.)

b) During the course, the Course Secretary functions as an "unofficial staff hostess," and:

(1) Attends course opening exercises, assisting students in completion of registration cards and associated records;

(2) Prepares course summary registration information, prepares class roster on first day of course and distributes copies to students and instructors, keeping copies for future records;

(3) Provides clerical/secretarial support to Course Coordinator and instructional staff as required;

(4) Receives incoming mail and messages for staff and students, expediting communications to extent practical and feasible;

(5) Prepares course certificates as specified by Course Coordinator on last day of course;

(6) Inspects classroom daily, making arrangements as necessary for coordination of deficiencies in janitorial services, and personally corrects minor deficiencies to extent feasible;

(7) Attends and participates in course closing exercises.

c) After the course, the Course Secretary:

(1) Prepares typed copy of all reports drafted by the Course Coordinator, and forwards reports as indicated;

(2) Places purchase orders or procurement requests for repair, renovation, or replacement of equipment and supplies as directed by Course Coordinator;

(3) Removes all course supplies from the classroom, returns borrowed resources, leaves classroom in condition suitable for use by following class (this does <u>not</u> imply janitorial services!);

(4) If course is conducted on a repetitive basis, inventories all consumable classroom supplies including data sheets, worksheets, quizzes, course schedules, and the like, and reorders or provides for reproduction of any items coming into short supply.

3) Instructors-Chemists

a) Before the course, each Instructor receives course duty assignment from management, and:

(1) Meets with Course Coordinator for discussions of course plans, objectives, and for development of day-to-day course preparation schedule;

(2) In conference with Course Coordinator determines which of any options in tests and measurements will be taught, determines lesson guides to be followed and student reference materials to be used, and resolves any other problems on instructional materials, their content, and related matters which should be determined beforehand;

(3) Reviews requirements for equipment, supplies, audiovisual training aids, and other training resources to be used in individual instructional assignments. Performs equipment upkeep and maintenance procedures, prepares supplies and reagents required to be available for student use. Provides Course Coordinator with timely, detailed information on specifications for all equipment, supplies and other training resources which must be purchased, rented, or borrowed for the course;

(4) If the course is to be conducted in a "field" location, packs equipment and supplies for shipment so that they will arrive at destination in good condition; identifies to the Course Coordinator the equipment and supplies which should not or cannot be shipped which should be provided otherwise at the course site;

(5) Rehearses all classroom and laboratory instructional presentations to the extent necessary to assure effective performance within the scheduled time allocation;

(6) Reviews and practices all tests for which he/she has responsibility as primary Instructor to assure personal proficiency and adequacy of pre-course plans and preparations. Supervises pre-course practice of those who will serve as assistant Instructors for the tests;

(7) Prepares to serve as assistant Instructor for specified tests and measurements, developing personal proficiency through pre-course practice under supervision of the applicable primary Instructor, and prepares to teach the tests and measurements in accordance with techniques specified by the primary Instructor;

(8) Reports periodically as requested to the Course Coordinator on status of course preparations, and cooperates in working out timely procedures for their accomplishment.

b) During the course, each Instructor:

(1) Attends and participates in course opening exercises;

(2) Serves as primary Instructor for the tests and measurements assigned to him/her. In this capacity he/she is responsible for all classroom instruction on the designated subjects, leadership of all laboratory instruction, collection of (or arrangements for) samples for laboratory examination by class, student performance evaluation and associated records for submission to Course Coordinator, and student counseling on pertinent matters related to area of personal responsibility;

(3) Assists primary Instructor in laboratory instruction phases of the tests and measurements as assigned, including preparation and organization;

(4) Attends and participates in all classroom start-of-day evaluation sessions on previous day's student performance;

(5) Attends and participates in course closing exercises.

c) After the course, each Instructor:

(1) Reviews the course implementation experience with the Course Coordinator, mutually developing proposals and plans for future offerings of the course;

(2) Evaluates condition of all equipment and supplies, initiating action to repair, renovate, or replace any items found deficient or in short supply;

(3) Takes necessary action to put laboratory into state of neatness and order for occupancy of the next course (this does <u>not</u> imply janitorial service!);

(4) If course was conducted in the field, repacks all equipment and supplies for return to home institution, after at least superficial cleaning of all dirty or contaminated glassware;

(5) On return of shipment to home institution, unpacks all equipment and supplies, returning it to designated custodial site, including return of borrowed equipment and other returnable resources.

4) Laboratory Assistant

The Laboratory Assistant is designated as "optional" in the staffing plan, but services of a Laboratory Assistant are strongly recommended. This is particularly urged in a fixed training installation where this and other courses are being conducted on a continuing or repetitive basis. The Laboratory Assistant works particularly in support of the

instructional staff. The Assistant will be given routine tasks which will free the instructional staff for more specialized or complicated tasks associated with the planning, preparation, and implementation of the training.

a) Before the course, the Laboratory Assistant:

(1) Works closely with the instructional staff members, performing standardized tasks as specified in the course preparation plan;

(2) Organizes laboratory supplies and equipment for each procedure in such a way as to permit distribution to the students or to their working sites with maximum efficiency during the course presentation;

(3) Assists Course Secretary wherever feasible in assembly and organization of student instructional materials, classroom preparation, and related tasks.

b) During the course, the Laboratory Assistant:

(1) Performs all possible tasks in support of primary Instructors in setting up student work positions, collecting and returning used glassware, supplies and equipment, etc., to central repository;

(2) Cleans and maintains all glassware and supplies excepting those stipulated for student performance;

(3) Notifies primary Instructor promptly of any noted discrepancies or deficiencies in supplies, equipment, or planning which would lead to problems in implementing the course;

(4) In field courses, packs equipment in shipping cases as rapidly as its use has been completed for the course.

c) After the course, the Laboratory Assistant:

(1) Assists Instructors in all equipment and supply inspection, renovation, and return to proper location;

(2) Puts laboratory in state of neatness and order preparatory to use for next class;

(3) Prepares any stable supplies required for next offering of the course, within limits of technical capability.

2. Training Facilities

This course requires both a classroom and a laboratory for class use. Effective presentation of the course requires staff attention to many details related to these facilities. Problems more often occur in field courses (i.e., away from "home base"). In any location it is unusual that all desired features of a training facility will be met, but with timely attention most problems can be solved or at least partially resolved.

a. General Considerations

1) Spatial Relationships

Classroom and laboratory should be separate, but close together. Much of the instruction requires frequent shifts between classroom and laboratory. Therefore, the classroom and laboratory must not be in separate buildings, and should not be far apart within any structure.

2) Associated Comforts

a) The classroom and the laboratory should have a comfortable temperature, be free of obvious drafts, be well-ventillated, and should be well-lighted. It is, of course, possible to develop specifications for acceptable temperature ranges, light intensity ranges, humidity, etc.; but there is no substitute for exercise of good judgment.

b) Suitable restroom and drinking fountain facilities should be convenient to the classroom and laboratory.

c) Smoking:

(1) NO SMOKING IN THE LABORATORY. There should be no compromise on this.

(2) Some schools permit smoking in the classrooms. If this is the practice, it is advisable to locate ashtrays so that smokers sit in an area where their smoking will not disturb others.

3) Lunchroom Facilities

Most schedules for this course will allow a one-hour lunch break. It is advisable that the course staff identify and make known to the class the names and locations of convenient dining facilities where service, variety, quality, and price are satisfactory.

4) Comments to Class about Facilities

a) On the first day of the course the general orientation should include such information as the class needs on the location and use of facilities and conveniences for class use.

b) It is strongly urged that the entire strining staff never at any time indulge in apologies or criticisms of the classroom or laboratory facilities being used. Such remarks serve no useful prupose and can only detract from an effective program, provided that everything possible has been done beforehand to resolve existing problems with facilities. Student comments and complaints should be given an honest repsonse, but such comments from students should not be regarded as an excuse for staff to enlarge on the subject.

b. Classroom

1) General Features

a) Door at rear of room is preferred; this permits entry of late-comers without excessive distraction of class.

b) The classroom should be free from excessive extraneous noises, such as from construction projects, heavy traffic, or from aircraft.

c) The classroom should have adequate electric power outlets (115 V) for use of audiovisual equipment. The receptacles should be inspected for assurance that they are compatible with the plugs on the audiovisual projector equipment being used, and adapters and extension cords secured as required.

d) Room size should be adequate for seating 18 students, plus providing for instructor equipment, projection equipment, and a modest number (4 to 8) of intermittent visitors to the classroom.

e) The classroom should be capable of being darkened quickly and effectively for use of projection equipment or television. Room dimmer lights for indirect lighting (not striking the screen directly) are recommended in fixed training installations, but can be dispensed within a field training situation.

2) Student Facilities

a) Ideally, students should be seated at tables, with all seats facing the instructor's area at the front of the classroom. Each student should be allocated 30" or more of table width. The sidearm chairs so familiar in the classrooms of secondary schools and colleges may be used if absolutely necessary, but are distinctly inferior to tables for student work.

b) Student seating should be at least two screen widths from the projection screen (assuming a 6' screen, no student closer than 12' from the screen) and not more than 6 screen widths from the screen (again assuming a 6' screen, no student more than 36' from the screen). Furthermore, all students should be seated seated within a 30° angle to the left and to the right of a line from the middle of the projection screen to the projector.

3) Classroom Instructional Facilities

a) Lectern, either freestanding or table-type; suitable for standing instructor

b) Demonstration table at front of classroom, approximately 3' x 5'

c) Chalkboard, at least 3' x 5' (preferably larger), with chalk, erasers, pointer

d) Audiovisual equipment

(1) Public address system (optional but recommended) with lavalier microphone with adequate cord length to permit instructor to move about at front of classroom with relative freedom

(2) Projection screen (for size consideration see 2) b above), matte, beaded, or lenticular surface

(3) Projector, 35-mm slide projector for slides mounted in cardboard or plastic mount; carousel type preferred. Should have projection lens with cord length suitable for use from rear of room

(4) Projector, overhead type, for use with projectuals approximately 7" x 9"

(5) Cassette type playback unit, with cueing feature for automatic operation of cassette type slide projector; compatible with National Training and Operational Technology Center (EPA) tape/slide instructional units

(6) Television tape playback unit (3/4" cassette type, "U-Matic" or equivalent)

(7) Television receiver, commercial type, color, 19" diagonal picture, or larger At least one receiver, preferably two

c. Laboratory

1) General Features

a) Should be well-lighted, adequately ventilated. It is particularly important that the laboratory be free from strong drafts in student working areas.

b) Should provide for students to stand at laboratory benches which are approximately 36" from floor to bench surface.

c) Conventional laboratory services should be available at student work areas, including electricity (115 V), gas, and vacuum.

d) Space between benches should be adequate for students to work without interfering with each other, and to permit free movement of instructors in the student working area.

e) Safety features of the laboratory should be checked, including location and condition of first aid kits, fire extinguishers, emergency showers, eye-wash facilities, and other emergency equipment.

2) Student Facilities

a) Provide at least 6' of bench width per student pair. While students will work in pairs to the extent that they will share certain limited equipment, each student will perform all tests and measurements.

b) Provide bench space or floor space as necessary for laboratory equipment described in the equipment and supply lists, such as balances, ovens, waterbaths and other items not assigned to individual student work.

3) Laboratory Instructional Facilities

a) A chalkboard and demonstration table are recommended.

b) Provide at least 20 square feet for reserve supplies and equipment of each instructor.

c) For field courses, provide area for packing and unpacking; areas for equipment to be shipped. This should be at least 100 square feet of floor space, with at least 20 square feet of table space.

d. Security

Valuable property is used both in the classroom and in the laboratory. Some of the items are particularly susceptible to theft. Accordingly:

1) Provide for locking of both classroom and laboratory when not in use, or assure that adequate security is provided in the facility by other means.

2) Be sure that the necessary keys are available to the instructional staff at their need.

3) With field courses, often it is necessary for the training staff to work in the evening or weekends to prepare for coming classwork. Arrangements must be made well in advance to secure authorized entry to the training facilities being made available by a host organization.

4) Thefts during normal working hours may be a special problem. Maintain surveillance to the extent practical, and keep out-of-service theft-prone items out of exposed locations.

3. Laboratory Equipment and Supply Requirements

The consolidated list in this section is for overall planning purposes. For day-to-day laboratory requirements, see the "IPW Equipment and Supply Requirements" and the "IPW Reagent Requirements" in each Instructional Package Worksheet contained in Part II of this Guide.

The quantities of laboratory materials needed for a course depend on the specific laboratory work assigned to each student. For the consolidated list in this section, the basis for quantities required is the assignment stated in each Instructional Package Worksheet (IPW).

The abbreviations used in the listing to refer to the various procedures that might be taught and the assignment given for each in the related IPW are stated in a table preceding the laboratory listing.

The listing itself is divided into three sections: capital equipment of more than $100 unit value, reusable equipment of less than $100 unit value, and consumable equipment of less than $100 unit value.

As noted, numbers represent minimum quantities. It is strongly recommended that instructors provide surplus equipment and additional supplies ready for use in case of need. Many instructors plan for a margin of at least 10% of extra supplies to provide for student errors, planning miscalculations, or other unforeseen events.

This list can be of great value in pre-course planning, to determine the availability of needed equipment and supplies, and to take action to provide needed resources. Further, this list can be of vital importance when planning for courses to be conducted in field locations. Copies of the list in the hands of the Course Coordinator and a representative of the host organization can be used to determine which will provide needed resources, on an item-by-item basis. When the responsibility is assigned/accepted, this can be annotated in the "remarks" column, with a copy of the annotated list in the hands of the Course Coordinator and a copy for the representative of the host organization. Each can then use the annotated equipment and supply list as a checklist for carrying out his own agreed-upon responsibilities in preparing for the course.

A. CAPITAL EQUIPMENT (More than $100.00 Unit Value)

DESCRIPTION	Quantity For: Class of 18	REMARKS
Balance, analytical with a 0.1 milligram sensitivity	2	For weighing reagent chemicals for the preparation of standard solutions
Refrigerator capable of maintaining a 4° C temperature	1	For storage of standard solution
Spectrophotometer, absorption	1	For colorimetric analyses
Water Bath, constant temperature to maintain 55± 2° C	1	For boron procedure
Water, still and mixed bed ion exchange resin cartridge to prepare metal free distilled water	1	Water used in all reagent preparation
Balance - triple beam 0.1g accuracy	1	Used for weighing reagent chemicals
pH meter	3	For pH determination of samples
Atomic absorption spectrophotometer	2	For metals analyses

DESCRIPTION	Quantity For: Class of 18	REMARKS
Pressure regulator valve: two stage regulator designed to deliver acetylene (CGA 510 fitting)	2	For fuel supply to AA spectrophotometers
Pressure regulator valve: two stage for air (CGA 1340 fitting)	2	For air supply to AA spectrophotometers
Magnetic stirrer - hot plate and magnet retreiver	1	For preparing reagent solutions
Steam bath and fume hood	1	For evaporation of samples
Flameless Mercury Analyzer System - Coleman MAS-50 or equivalent	1	For mercury determination
Recorder (optional)	1	For mercury determination
Flame Photometer	2	For flame photometric procedures
Oven, drying (100°C)	1	For sodium and potassium determination

B. REUSABLE EQUIPMENT (Less Than $100 Unit Value)

DESCRIPTION	QUANTITY FOR CLASS OF 18	REMARKS
Aprons, laboratory (plastic acceptable)	18	
Beakers, 100 ml	18	
Beakers, 150 ml	18	
Beakers, 250 ml	18	
Beakers, 600 ml	18	
Bottles, glass, 250 ml with glass stoppers	18	
Bottles, glass, 500 ml with glass stoppers	9	
Bottles, glass, 1000 ml with glass stoppers	27	
Bulb, pipette	9	
Buret, 50 ml glass	9	
Cylinder, graduated, 10 ml	18	
Cylinder, graduated, 50 ml	9	
Cylinder, graduated, 100 ml	9	
Dishes, evaporating, porcelain, 100 ml	54	
Flasks, volumetric, 100 ml	152	
Flasks, volumetric, 1000 ml	13	

DESCRIPTION	QUANTITY FOR CLASS OF 18	REMARKS
Flasks, erlenmeyer, 125 ml	9	
Flasks, erlenmeyer, 250 ml	9	
Flasks, erlenmeyer, 500 ml	9	
Funnel, fluted, 60°, 50 mm, diameter 65mm stem	9	
Funnel, 80 mm diameter	9	
Mortar and pestle, 70 ml porcelain	9	
Paper Clips	9	
Pipet, Mohr, 10 ml	9	
Pipet, volumetric, 1.0 ml	90	
Pipet, volumetric, 2.0 ml	9	
Pipet, volumetric, 3.0 ml	36	
Pipet, volumetric, 4.0 ml	9	
Pipet, volumetric, 5.0 ml	9	
Pipet, volumetric, 8.0 ml	9	
Pipet, volumetric, 10.0 ml	9	
Pipet, volumetric, 50.0 ml	36	
Pipet, volumetric, 100 ml	9	
Ring Stand and 3 inch ring	9	

DESCRIPTION	QUANTITY FOR CLASS OF 18	REMARKS
Stirring Rod, (policeman), six inches	9	
Thermometer, degrees C	1	
Wash Bottles, polyethylene, squeeze type	9	
Watch Glass, 100 ml diameter	9	

* Quantities given are for participants working in pairs. To equip class working individually double numbers listed.

DESCRIPTION	QUANTITY	REMARKS
	For a class of eighteen.	
Acetylene (cyl DOT - 8a1)	1	
Air (dry grade DOT - 3aa 2015	1	
Ammonia hydroxide concentrated	5 lbs	
Boric acid (H_3BO_3), ACS, reagent anhydrous powder	1 lb	
Bromphenol blue (ACS)	5 g	
Brush, bottle	3	For cleaning glassware
Calcium Carbonate	1 lb	
Carbon disulfide (ACS)	1 lb	
Chloroform (ACS)	1 lb	

DESCRIPTION	QUANTITY	REMARKS
Copper metal (ACS reagent)	1 lb	
Curcumin, Eastman No. 1179 or equivalent	25 g	
EDTA (Ethylenedinitrilotetra-acetic acid disodium salt)	1 lb	
Eriochrome blue black R indicator	5 g	
Ethyl alcohol, 95%	3 kg	
Filter paper, Watman No.3	1 Box	For funnel in Boron Analysis
Glass tubing (5mm diameter)	2 ft	
Glass wool	1 lb	
Graph paper 8½" x 11"	3 Tablets	
Hydrogen peroxide, 30%	1 lb	
Hydrochloric acid - concentrated	5 lbs	
Hydroxylamine sulfate (ACS)	1 lb	

CONSUMABLE SUPPLIES

DESCRIPTION	QUANTITY	REMARKS
Illonizing column (Fisher # 9-034-3)	1	
Lables for reagent bottles	3 dozen	
Laboratory notebooks	18	
Lead nitrate (ACS)	¼ lb	
Magnesium metal (ACS reagent	1 lb	
Magnesium perchlorate (ACS)	1 lb	
Marking pen or wax pencil	9	
Matches, packet	2	
Mercuric chloride (ACS)	1 lb	
Methyl red indicator	5 g	
Nitric acid, ACS reagent	7 lbs	
Nitric acid - concentrated	5 lbs	

C. CONSUMABLE SUPPLIES

DESCRIPTION	QUANTITY	REMARKS
Oxalic acid, ACS reagent	1 lb	
Oxygen	1 cyl	For flame photometry
pH paper (phydrion)	1 package	
Potassium chloride (ACS)	1 lb	
Potassium dichromate	1 lb	For cleaning glassware
Potassium permanganate (ACS)	1 lb	
Potasssium persulfate (ACS)	1 lb	
Pyrrolidine (ACS)	½ lb	
Soap	1 lb	For cleaning glassware
Sodium chloride	1 lb	
Sodium dichromate (ACS)	1 lb	
Sodium hydroxide	1 lb	

C. CONSUMABLE SUPPLIES

DESCRIPTION	QUANTITY	REMARKS
Sponges	9	
Stannous sulfate (ACS)	1 lb	
Sulfuric acid (ACS)	1 lb	
Tissues, lint free	9 small boxes	For wiping spectrophotometer cells.
Towels, paper	4 packages	
Water, distilled, metal free	5 kg	
Weighing boats, disposable plastic	3 dozen	
Zinc metal (ACS reagent)	1 lb	

4. Instructional Resources

a. Introduction

Most training institutions will make the fullest possible use of pre-existing instructional resources. The purpose of this section is to describe the nature, sources, and availability of instructional resources suggested for use with this course.

1) The Instructional Package Worksheets (IPWs) in Part II of this Manual and the student reference text refer to a number of different instructional resources. These include:

   a) The student reference text itself;

   b) Audiovisual training aids; and

   c) Supportive references

2) Instructional resources are discussed in this section from the viewpoint of the sources of the materials:

   a) Resources developed by United States Environmental Protection Agency (U.S. EPA)

   b) Resources developed by other sources; and,

   c) Resources already in possession of the training institution conducting this course.

b. Instructional Resources Developed by U.S. EPA

1) Student Reference Text and Staff Guide for the course "Effluent Monitoring Procedures Nutrients":

   a) While present supplies last, a sample copy (can be duplicated) is available on specific request to:

      National Training and Operational Technology Center
      ATTN: Training Information Clerk
      U.S. Environmental Protection Agency
      Cincinnati, Ohio 45268

   b) NTOTC has negatives of the Text and Guide which are available for temporary loan on request of a sponsoring Agency wishing to duplicate the materials.

c) NTIS can supply copies of the Text and Guide. A paper copy of the Text (PB-261-290/AS) costs $9.75. Contact NTIS for the identification number and cost of a paper copy of this Guide.

A microfiche copy of either the Text or Guide is also available from NTIS at $3.00 each.

U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22151

d) Your state agency may be able to arrange a direct supply of the texts and/or guides. Before ordering/reproducing materials, you might consult with your state agency about this possibility.

2) Audiovisual Training Aids developed for the course:

a) Audiovisual training aids are listed in the respective IPW's for this course.

b) How to request loan of audiovisual training aids:

(1) All items described in the IPW's are available on scheduled loan from NTOTC to institutions conducting this course. Requests should contain the information items on the "Request for Loan" form (next page). Send requests to NTOTC at the address given in b.1)a) above.

(2) It is urged that materials desired from NTOTC for a specific course offering be requested in a single, consolidated communication. This will give greatest assurance of a well-coordinated response. Because these requests ordinarily will cover a number of different items, telephonic requests should not be made.

REQUEST FOR LOAN
AUDIOVISUAL INSTRUCTIONAL UNIT

Title and Catalog No. _____

_____

Intended Use: _____

_____

Preferred Date of Use: _____

Alternate Date: _____

BORROWER'S NAME _____

Title _____

Organization _____

Address _____

_____

(Zip)

Phone Number (include
Area Code): _____

There is no charge for use of the Audiovisual Instructional Units. However, the *BORROWER* assumes financial responsibility for the value of all loaned equipment and instructional materials.

Unless special arrangements are made with the loaning office, units should be returned within two weeks. Return the unit by *REGISTERED, CERTIFIED* or *INSURED MAIL IMMEDIATELY* after use.

(3) Requests should be timely. To assure effective delivery in time for use in the course, requests should be received at NTOTC at least 45 days prior to the course date. The Center will, in turn, make every effort to assure that the requested materials are delivered to the requesting institution several days prior to the start of the course in which they are to be used. This will permit review and practice by the instructional staff for the most effective use of such resources.

(4) It is expected that all borrowed resources be returned to the Center within two weeks after completion of the course in which they are used.

(5) With returned borrowed training resources, it is requested that the user provide the Center with an evaluation of the training resource(s) used. In this manner the experience of users can be a factor in continuous improvements and responses to problems in using the resources. All reports on use of such resources should include the number of students with whom the material was used.

3) Supportive References:

a) Manual: EPA-EMSL, "Methods for Chemical Analysis of Water and Wastes". This is the reference source of all the methods presented in this course in the Effluent Monitoring Procedure (EMP) format. Address requests for a copy to:

U.S. EPA
Office of Technology Transfer
Industrial Environmental Research Laboratory
Cincinnati, Ohio 45268

b) AV Catalog: NTOTC, "Audiovisual Instructional Units". This is a catalog of slide-tape instructional units developed by the Center. Although not developed specifically for this course, several of the units are on course topics and might be useful supplementary material. Address requests for a copy to NTOTC at the address given in b. 1) a) above.

c) IRIS: A Water Quality Instructional Resources Information System has been developed through an EPA training grant. The "Master Reports" contain availability information and descriptions for 2300 entries of instructional and resource materials. These are printed matter, slides, films, slide-tape units and video tapes developed by varied sources for training personnel involved in all aspects of water quality assessment and control. Thus, IRIS serves as an information source of available, water quality training resources covering a wide range of subjects.

The user does not need data processing equipment to use the system. Four of the commonly used elements of IRIS (Users Manual, Tables, Master Report, Subject Index) are currently available.

(1) While present supplies last, a set is available to qualifying educational institutions and training agencies from NTOTC at the address given in b.1)a) above.

(2) Paper copies can be ordered as a set of four volumes from NTIS (PB-262-223/AS, Set, 1120 pp. "Water Quality Instructional Resources Information System, Volumes I through IV) for $31.00. The NTIS address is given in b.1)c) above. Microfiche copies cost $12.00 per set.

(3) Paper or microfiche copies of individual volumes can also be ordered from NTIS at the address given in b.1)c) above using this information:

(a) PB-262-224/AS, 99 pp., "Water Quality Instructional Resources Information System, Volume I-Users Manual" @ $5.00. (microfiche $3.00)

(b) PB-262-225/AS, 96pp., "Water Quality Instructional Resources Information System, Volume II-IRIS Tables" @ $5.00 (microfiche $3.00)

(c) PB-262-226/AS, 494 pp., "Water Quality Instructional Resource Information System, Volume III - Identification Number Master Report" @ $12.50 (microfiche $3.00)

(d) PB-262-227/AS 431 pp., "Water Quality Instructional Resources Information System, Volume IV - Subject Index" @ $11.75 (microfiche $3.00)

c. Instructional Resources Developed by Other Sources

1) Minimum technical references which should be in possession of the institution include:

a) "Standard Methods for the Examination of Water and Wastewater" (14th ed), APHA, AWWA, WPCF. Available from Publications Office, American Public Health Association, Inc., 1015 18th Street, NW, Washington, D. C., 20036.

b) "Annual Book of Standards" Part 31, "Water", 1975. Available from American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.

2) Audiovisual and Other Training Aids

a) A wide variety of training resources is listed in the EPA sponsored publication, "Water Quality Instructional Resources Information System" (IRIS), cited in b, 3) c) above.

b) Information on sources of the listed items is provided.

c) Training institutions having information about training resources applicable to this course, which are not currently listed in IRIS, are invited to relay this information to the Director, National Training and Operational Technology Center. Such resources, as applicable, will be made known to other organizations which could benefit from their use.

d. Instructional Resources Already in Possession of the Training Institution

1) Many training organizations prefer to develop their own texts and audiovisual training resources.

2) To the extent that these resources can be released for free reproduction and use by others, institutions are invited to make such resources available to other training organizations.

3)The National Training and Operational Technology Center is prepared to serve as a focal point for making information about such resources widely available, provided that copyright or other restrictions on reproduction do not limit availability of such materials.

a) Before encouraging other training institutions to use such resources in relation to this Course, elements of EPA will:

(1) Review the training resources to determine whether the instruction is consistent with existing laws, regulations, and Agency policy;

(2) Review the resource for technical validity and educational quality.

b) Materials found suitable by EPA would be recommended to other institutions known to be presenting this Course.

4) All training resources referred to NTOTC as available for use by others will be added to the overall inventory listing cited in IRIS, b. 3) c), above. It is hoped that a mutually supportive activity in this area will, in time, result in:

a) making IRIS a diversified, total resource system for training materials which will be of the highest technical quality;

b) offering training institutions a wide variety of types of training resources;

c) reducing the amount of duplication of effort that so often results from lack of information on what is available, from what sources, and how obtained.

PART I - COURSE PLANNING AND MANAGEMENT

C. Secretarial Support

The key role of the office worker(s) designated "Course Secretary" cannot be overemphasized.

This function has many elements including being the right arm of the Course Coordinator, being Course Registrar, being Course Secretary and being a "Course Watchdog" to give the alarm when essential milestone stages of course planning and preparation are being overlooked.

In this section, these elements are considered under the headings: Course Records and Record-keeping, Suggested Student Registration Procedures and Printed and Reproduced Materials - Summary.

1. Course Records and Record-keeping

a. General Considerations

1) Complete, detailed, and accurate records should be established for each course presentation. Each course record will be a separate file. In addition to the individual course files, it may be necessary to establish a finder-system for locating the records of individual students.

2) Response to Inquiries about Former Students

a) Students enroll in this course in order to acquire necessary knowledge and skills to perform the self-monitoring procedures required for municipal effluents.

b) In many, if not all cases, satisfactory completion of this course will be a factor in the accreditation of individuals to perform the analyses and measurements required for compliance with NPDES Permits.

c) It is anticipated that numerous inquiries from former students and from regulatory agencies will be addressed to the training institution. Typical requests for information may include any or all of the following:

(1) Verification of attendance and satisfactory completion of training;

(2) Identification of the specific analyses and measurements covered in the course, as well as designation of the method which was taught;

(3) Quality of student performance in the course;

(4) Documentation of any specific analyses, tests, or measurements in which the student did not meet the required standard of performance, and the nature of such failure; and

(5) Documentation of any other events which made the student unusual. This could be a record of exceptionally high performance, or it could be a record of any specific difficulty which arose in connection with the student, within or outside the scheduled training activities.

3) Reports

Most training institutions require submission of periodic reports on progress and achievements. It is safe to predict that management or cognizant regulatory agencies from time to time will call for information not provided in routine reports. If such demands are to be met, complete course records will be the most reliable source for such information.

4) Retention of Records

The length of time course record files should be retained is uncertain, and must be determined by each institution.

Institutions having a system of archives for inactive files may find it convenient to retain course records in active office files for approximately two years, then retire them to archives storage. Institutions not having archives storage probably should retain the complete file on each course presentation for at least five years.

b. Contents of Course Files

1) In the planning and development stage, and until completion of each course presentation, course records are kept most effectively in two sections.

These are:

a) A file folder, kept in the filing cabinet or in the desk of the Course Secretary; and,

b) A student record notebook, usually a 3-ring binder, kept on the Course Secretary's desk, or in a convenient bookcase.

Both sections of the Course files should be maintained by the Course Secretary, and should be made available to other staff members under rigid controls providing for direct examination and immediate return. After completion of the course, the two sections can be combined in a single large file packet for future retention.

2) The file folder is best suited for such records as:

a) Copies of all correspondence, memoranda, and records of telephonic conferences related to course planning and development;

b) Copies of course schedules;

c) Records of equipment and supply acquisition for the course, through purchase or through loan (with information and records on return to owner);

d) Records of staff assignments, classroom and laboratory reservations;

e) Copy of course announcement and/or description (See pages 12-7 and 8);

f) Sample record copies of all routine informational material sent to students accepted for training; (See pages 12-13 through 16);

g) Records of arrangements for travel of personnel and transportation of equipment and supplies, arrangements for field facilities, and other records pertaining to a field course; and

h) Course evaluation commentaries by Course Coordinator and other staff members as appropriate.

3) The student record notebook is best suited as a vehicle for all records and copies of communications related to individual students. This may be organized effectively in a 3-ring notebook, containing separator sheets with alphabetical tabs. The personal records of each student will be retained under the alphabetical tab corresponding with his last name. In the student record notebook may be found:

a) At the front (before the "A" of the series of tabbed dividers):

(1) A registration summary sheet showing record of standard communications with each accepted student, fees paid, etc... (See page 12-17);

(2) A waiting list summary sheet showing record of standard communications with each student placed on a waiting list prior to the course due to early maximum enrollment. (See page 12-18

(3) A non-attendance summary sheet showing record of students who applied for admission but could not be admitted for lack of qualification, or due to an already-filled class. This summary also is used to identify applicants who applied for admission, who were admitted, and who failed to appear without due explanation ("no shows"). (See page 12-19);

(4) A summary sheet recording student performance (acceptable or not acceptable) for each of the units of instruction in the course. (Such a summary worksheet has not been developed at the writing of this Guide).

b) In the alphabetical section of the student record notebook, each student's personal record will contain such items as:

(1) The application for admission to training (See pages 12-7 and 8);

(2) Copies of all correspondence with the student (See pages 12-11 through 14), except for the routine local information sheets (See pages 12-15 through 18), one set of which is kept in the loose file folder;

(3) Record copies of student quizzes, data sheets, and other individual records of class performance provided by Instructor.

(4) Copy of the certificate awarded at end of course which is a record of the measurements completed by the student in a satisfactory manner. (See page 12-22);

(5) Documentation of any information about the student judged to be of possible future concern or inquiry. (An example of such a sheet had not been developed at the time of writing this Guide).

2. Suggested Student Registration Procedures

a. Introduction

1) Purpose

Formal registration and enrollment procedures are intended to assure that:

a) The class consists of students for whom the training is intended and designed;

b) The accepted students meet minimum knowledge and skills required for reasonable assurance of satisfactory completion of the course;

c) Accepted students are provided with adequate pre-training information so that they will make their personal arrangements and travel schedules to assure arrival at the appointed time and place, with full participation throughout the program of training;

d) The size of the class is in accordance with the course plan; and

e) Those not accepted for training are provided with suitable advice which can lead to future admission.

2) Alternative Approaches to Registration

Three different approaches to registration are considered here, though only the first is described in detail. Most details of the second and third identified alternatives can be inferred through study of the first alternative. The three approaches considered are:

a) Registration by priority of receipt of application;

b) Registration by comparative evaluation of all applicants; and

c) Registration for special course offering at request of another organization. Students are nominated by the requesting organization and are accepted without further evaluation of entry-level qualifications by the training institution.

b. Registration by Priority of Receipt of Application (Recommended)

1) Applicant

a) Receives course announcement;

b) Completes application and secures internal approvals as required in his own organization;

c) Mails application to registration office of the institution conducting the training.

2) Course Secretary

a) Receives application;

b) As received, checks status of registration for availability of class space, and makes appropriate notation on the application or on attached transmittal slip;

c) Depending on b), records application either in the registration summary, or the waiting list summary, in front of student notebook;

d) Delivers application to Course Coordinator.

3) Course Coordinator

a) Evaluates the student application and the space availability situation;

b) Directs the Course Secretary by notation on the application to:

(1) Accept the applicant, or

(2) Notify the applicant of closed class enrollment, or

(3) Refer the applicant to the "Basic Laboratory Skills" course before entry into this course;

c) Prepares a special letter for non-admissable applicants (or memorandum record of other form of communication with applicant) which sets forth the reasons why the applicant is being rejected. Because of the compulsory nature of the self-monitoring tests on municipal effluents for NPDES Permit compliance, rejection of a bona fide applicant may be a very serious matter, and should be handled with care.

4) The Course Secretary

a) Prepares a standard letter or special letter as directed, and obtains signature of Course Coordinator:

b) Places a file copy of the letter and the application in the appropriate place under the alphabetical tab section of the student record notebook;

c) Mails the original letter to the applicant, and records the the date of mailing in the appropriate place in the summary records at the front of the student notebook.

d) Approximately 30 days before the course, mails to each accepted applicant a standard communication, consisting of

(1) A form letter of welcome to the course, including information on starting and closing dates and hours of the course, directions and how to proceed to the classroom area, and related information (See page 12-12); and

(2) Local information helpful to outside visitors, such as hotel/motel information, local transportation and schedules, a schematic map of the area, and related information. (See pages 12-13 through 16);

e) Records the mailing of the standard packet on the registration summary sheet.

f) When applications are still being accepted within 30 days before the start of the course, includes the general informational material with the letter of acceptance for admission.

g) On the first day of the course:

(1) Obtains a detailed registration card from each student. Some institutions may dispense with this record, though it can be of value in report preparation (See page 12-20);

(2) Prepares any registration tallies required by requesting organization(s) and/or administrative regulations. (See page 12-21);

(3) Prepares a class roster of those in attendance, distributes to class, staff, and keeps a permanent record copy in course files;

(4) Records any "no shows" (applicants accepted for training but who did not appear) on the student non-attendance summary record sheet. (See page 12-19)

c. Registration by Comparative Evaluation of all Applicants

1) Applicant

a) Receives course announcement;

b) Completes application and secures internal approvals as required in his own organization;

c) Mails application to registration office of the institution conducting the training.

2) The Course Secretary

a) Receives the applications;

b) Records receipt of application in a summary record in student record notebook;

c) Files application in student notebook;

d) Sends standardized letter acknowledging the application, and briefly explaining the registration procedure, with assurance that decision on admission will be announced not less than 30 days prior to start of the course;

e) Delivers all applications to the Course Coordinator , approximately 35 days before start of the course.

3) The Course Coordinator

a) Reviews and evaluates all applications;

b) Selects students to be admitted for training;

c) Directs Course Secretary to send appropriate standardized letters and information packets as described in b. above;

d) Special note should be taken of the particular attention which should be given to rejected applicants. See b., 3), c). above.

4) The Course Secretary

a) Sends communications;

b) Prepares records and student files as described in b.4) above.

d. Registration for Special Course Offering

Here a requesting organization has designated a student body which it wishes to have trained. It is the duty of the training institution to provide the requesting organization with admission standards for the course. It becomes the duty of the requesting organization to screen its candidates for conformance to these standards, and to provide the training institution with the names of the students to be trained. The requesting organization usually notifies the students.

1) For record purposes, it is best that students complete a course application form, though it will not be evaluated as in b. and c. above.

2) On receipt in the training institution, the Course Secretary makes the necessary entries showing record of receipt and class composition. Files are kept in the usual way. Approximately 30 days before the course, the individual standardized welcome and information packets are sent to students in the usual way. The training organization follows its usual practices in preparation of records, rosters, and any other data required for reports.

3. Printed and Reproduced Materials - Summary

a. General Information

In addition to the student reference text, standardized letters and administrative forms/materials, presentation of this course also requires calculation forms, laboratory data sheets, and graph forms which must be prepared in quantity by the Course Secretary.

1) In the following summarizing table, all of the standardized materials noted above are identified and supported with additional information on due date, the number to be prepared (for a class of 18 students), and the ultimate fate of the materials in permanent course records. Institutions offering this course may find it necessary to add to or to modify these standardized materials. It is suggested that plans to do so be noted on the summarizing table, with samples or examples provided on separate pages.

2) A sample or example of each item listed (except the student reference text) is shown following the summarizing table.

a) Samples can be copied directly, if meeting requirements of the training institution.

b) The examples are shown in recognition that a corresponding item probably will be needed by the training institution, but probably will have to be modified to fit the situation.

b. Responsibilities for Printed and Reproduced Material

1) Course Coordinator

a) Reviews the administrative materials for conformance to the requirements of the regulatory authority;

b) Makes modifications as necessary to the samples and examples provided in this Guide;

c) Decides upon and designs any additional administrative documents or records needed; and

d) Provides the Course Secretary with complete identification of material to be copied directly or to be modified, and also provides samples of any new material required for course administration.

2) Instructors

a) Review all materials identified for the procedures for which they have instructional responsibility;

b) Design new supportive instructional material as required; and

c) Provide the Course Secretary with complete information on material to be copied directly or to be modified, and also provide samples of any new material required for student instruction.

3) Course Secretary

a) Receives from Course Coordinator and Instructors identification of existing materials, samples of modified and new material;

b) Adds to the summarizing table, in the appropriate locations, the identifying information, together with the supporting information on due date, quantity, confidentiality, and ultimate fate of any new or revised material designed by Course Coordinator or by Instructors;

c) Reproduces, or arranges reproduction of, the needed course materials so that they will be available for use at the time and place required.

c. Special Warnings

1) All staff members should be particularly alert to adjustments in "Due Date" which must be made when the course is conducted in the field, if training equipment and supplies must be shipped to the course site.

2) Preparation of these training materials is a potential source for great difficulty in course development and presentation. Few activities in course planning and development require a greater amount of effective teamwork among all staff members. The greatest problem here is one of <u>timing</u>.

a) <u>All</u> staff members <u>must</u> provide necessary information and samples of new or modified materials with adequate lead time to meet "Due Dates." The amount of lead time is not specified here; this will vary from one institution to another.

b) The Course Secretary <u>must</u> be diligent in advising Course Coordinator and Instructors of impending logistic problems if delays occur in submission of materials, and <u>must</u> give prompt attention to printing or reproduction of needed materials when delivered by staff members.

c) The author of this guide ruefully confesses that the worst and most frequent breakdowns in this area usually are the result of belated delivery of needed material from Instructional Staff to the Course Secretary.

SUMMARY OF REQUIRED PRINTED/REPRODUCED MATERIAL

Description	Lesson	When Needed	Number to be Prepared	Confidential ?	Permanent Record?	Remarks
Administrative						
Course Announcement	-	6 months before course	Indeterminate	No	1 copy	Distribute to target group 6 months before course.
Course Description	-	6 months before course	Indeterminate	No	1 copy	Same as announcement. Can be used in conjunction with chronological course listings.
Application for Admission	-	6 months before course		No	No	Usually part of course announcement. May be separate sheet.
Prerequisite Verification	-	6 months before course	Indeterminate	No	1 copy	Attached to application form
Standard Letter: Acceptance	-	5 months before course	100	No	No	Copies will show up in student files.
Standard Letter: Standby: Full Class - Waiting List	-	5 months before course	100	No	No	Copies will show up in student files.
Standard Letter: Referral to Basic Lab Skills Course	-	5 months before course	100	No	No	Copies will show up in student files.
Standard Letter: Welcome and Local Information: Hotels/Motels, Transportation Schedule, Schematic Area Map Classroom Location	-	30 days before course	100	No	1 copy	In Course file folder.
Registration Summary Record	-	5 months before course	1	No	Yes	In Registrar's three-ring notebook

Description	Lesson	When Needed	Number to be Prepared	Confidential ?	Permanent Record?	Remarks
Administrative (Cont'd.)						
Waiting List Summary	-	90 days before course	1	No	Yes	In Registrar's three-ring notebook
Non-attendance Summary	-	First day of Course	1	No	Yes	In Registrar's three-ring notebook
Trainee Registration Card	-	First day of course	20	No	Yes	Institution's Records
Registration Tally and Class Roster	-	First day of course	As required	No	Yes	In course file folder
Course Certificates	-	Final day of course	18	No	Yes	In student file
Student Performance Summary Record	-	Final day of course	1	Yes	Yes	In Registrar's three-ring notebook
Classroom/Laboratory						

(EXAMPLE ANNOUNCEMENT)

ANNOUNCING
USEPA SPONSORED INSTRUCTOR TRAINING FOR PERMIT COMPLIANCE

The National Training and Operational Technology Center has developed a series of "packaged" courses for training municipal treatment plant personnel how to sample, measure, and analyze their wastewater discharges so as to comply with NPDES Permit requirements. Instructional materials for each course have been prepared in modular form, with each module containing detailed step-by-step procedures for the performance of a specific monitoring task. A description of each course so far developed appears below.

The National Training and Operational Technology Center provides tuition-free courses for instructors engaged in this type of training in Federal, State, and Local water pollution control programs, and in educational institutions. In these courses the student-instructors perform each self-monitoring task. In addition, they become thoroughly familiar with the organization and recommended use of the instructional materials; with training aids and other technical assistance available from USEPA for this type of training; with the planning and implementation of intensive training programs; with recommended instructional techniques; and with USEPA regulatory requirements for NPDES self-monitoring. These latter subjects are dealt with in depth only in course 164.1 which is an 8 day offering for student-instructors. It is recommended that interested instructors attend this course prior to any of the others.

164.1
Effluent Monitoring Procedures:
Basic Parameters for Municipal Wastewaters
5 days
(8 days for student-instructors)

This course is intended for municipal wastewater treatment plant technicians and others engaging in analysis of wastewater treatment plant effluents for compliance with requirements of discharge permits issued under the National Pollutant Discharge Elimination System. Upon completion of training, the student will be able to collect samples, perform the tests, and report results for BOD, fecal coliforms, pH, suspended solids, residual chlorine, and measure flow by weir and parshall flumes. Laboratory test procedures conform to Agency-approved methods as promulgated in the Code of Federal Regulations.

164.2
Effluent Monitoring Procedures:
Metals Analysis
5 days

This course is designed for wastewater treatment plant technicians who will be responsible for performing selected metals analyses in treatment plant effluents. Participants will perform selected metals analyses including: boron, copper, iron, mercury, sodium, and zinc. Classroom instruction is limited to information about performing these analyses and reporting the results. Most of the time is given to laboratory experiences for the trainee who uses detailed, stepwise procedures to analyze typical samples. Procedures will be in conformance with Agency-approved methods as promulgated in the Code of Federal Regulations.

164.3
Effluent Monitoring Procedures:
Nutrients
5 days

This course is designed for municipal wastewater treatment plant technicians who are responsible for self-monitoring of nutrient concentrations in treated effluents to comply with requirements of discharge permits issued under the National Pollution Discharge Elimination System. Upon completion of the course, participants will be able to perform selected analyses for Chemical Oxygen Demand, the Nitrogen Series (Total, Ammonia, Nitrate, Nitrite), Total Phosphorus. The test procedures conform to Agency-approved methods as promulgated in the Code of Federal Regulations.

164.5
Effluent Monitoring Procedures:
Flow Measurement & Sampling Techniques
5 days

This course is designed for the treatment plant operator or technician who is required to monitor effluent discharges under a National Pollutant Discharge Elimination System (NPDES) Permit, and who has had little or no previous experience in collection of wastewater samples, or in measuring wastewater flows. Following classroom discussions and demonstrations, participants measure flows and collect samples at a wastewater treatment plant using both manual methods and automatic devices, and also measure effluent parameters on-site, using portable field instrumentation.

APPLICATION FOR INSTRUCTOR TRAINING

I am interested in attending the following training course or courses in Cincinnati, Ohio:

1. Effluent Monitoring Procedures: Basic Parameters for Municipal Wastewaters (164.1) July 11–20, 1977 ☐
2. Effluent Monitoring Procedures: Metals Analyses (164.2) June 13–17, 1977 ☐
3. Effluent Monitoring Procedures: Nutrients (164.3) August 1–5, 1977 ☐
4. Effluent Monitoring Procedures: Flow Measurement and Sampling Techniques (164.5) June 27 – July 1, 1977 ☐

(For additional offerings of these courses, call the NTOTC Registrar – 513/684–7501)

Organization in which you will be providing instruction: _____

Your Name _____ Phone _____

Business Address _____

_____

_____

EFFLUENT MONITORING PROCEDURES:
METALS (Course 164.2)

5 Days

This course is designed for wastewater treatment plant technicians who will be responsible for performing selected metals analyses in treatment plant effluents. Participants will perform selected metals analyses including: boron, copper, iron, mercury, sodium, and zinc. Classroom instruction is limited to information about performing these analyses and reporting the results. Most of the time is given to laboratory experience for the trainee who uses detailed, stepwise procedures to analyze typical samples. Procedures will be in conformance with Agency approved methods as promulgated in the Code of Federal Regulations.

PRE-REQUISITES

Self-Monitoring Procedures: Course I - Basic Laboratory Skills or equivalent experience is pre-requisite for the course. A "Student Skills Checklist," signed by the applicant's employer, must be submitted before an application for the course can be processed.

June, 1976

TUITION: $175.00

SAMPLE SAMPLE

COURSE APPLICATION FORM

1. **Name of Applicant:** Mr. / Miss / Mrs. _____ (last) _____ (first) _____ (middle initial)

2. **Course desired:** Course Title _____ Course No. _____
   Place where given _____ Dates _____

3. **Previous Courses Attended:**
   Course Title _____ Dates _____
   Course Title _____ Dates _____
   Course Title _____ Dates _____

4. **Sponsor or Employer:** _____
   (name of organization or firm)
   _____
   (street address)
   _____
   (city) (state) (zip code) (telephone)

5. **Mailing address of applicant:** (if different from above)
   _____
   (street address)
   _____
   (city) (state) (zip code) (telephone)

6. **Job Duties:** (Briefly describe your present position)
   _____
   _____
   _____
   _____
   _____

7. **Education:** Last year of school completed _____

8. **Experience:** Total years in wastewater treatment plant work _____

9. **Student Skills Checklist:** This checklist must be submitted before Application can be processed.

   _____
   signature of supervisor (where applicable) title

   _____
   signature of applicant date

(SAMPLE STUDENT SKILLS CHECKLIST)

Name _____

Employer _____

To assist us in processing applications, please check YES or NO for each of the following items:

	YES	NO
I have operated a laboratory gas burner	___	___
I have operated a laboratory hotplate/stirrer	___	___
I have operated an autoclave	___	___
I have operated a laboratory drying oven	___	___
I have used a vacuum source to filter liquids	___	___
I have used a desiccator	___	___
I have weighed items on an analytical balance	___	___
I have weighed items on a single pan balance	___	___
I have used a graduate to measure liquids	___	___
I have used a volumetric pipet to measure liquids	___	___
I have used a graduated (Mohr) pipet to measure liquids	___	___
I have used a pipet bulb to fill a pipet	___	___
I have used a volumetric flask to prepare solutions	___	___
I have used chromic acid to clean glassware	___	___
I have operated a laboratory safety shower	___	___
I have operated a laboratory eye washer	___	___
I have operated a fume hood	___	___
I have prepared 0.0375N potassium biiodate solution	___	___
I have made out labels for bottles of reagents	___	___
I have recorded a reading at a meniscus	___	___
I have titrated one solution against another to a color change end point	___	___
I have calculated the normality (N) of a solution	___	___
I have recorded laboratory data in a laboratory notebook	___	___
I have entered laboratory data on a pre-printed form	___	___
I have recorded information about samples on record sheets	___	___
I have located required purchase information in a catalog of laboratory equipment	___	___
I have written a purchase order for chemicals	___	___
Volume means space occupied by a solid, liquid, or gas	___	___
mg/l means milligrams per liter	___	___
1 kilogram equals 0.001 gram	___	___
1 inch equals 2.54 cm	___	___
1000 ml equals 1 liter	___	___
85 times 4.1 equals 42.5	___	___
7 minus 2 divided by 0.02 equals 250	___	___
3.26 rounded to the nearest tenth is 32.6	___	___
84.55147 rounded to the nearest thousandth is 84.551	___	___

(Institutional Letterhead)

(Date)

To

Dear (Name):

A reservation has been confirmed for your participation in the course "Effluent Monitoring Procedures: Metals", to be conducted at (address, including building and room identification if pertinent).

Formal class activities will begin promptly at 8:30 AM on Monday, (date) and the course will be completed by 12:30 PM on Friday, (date). Please arrange your travel schedule so that you will be in the classroom at the start of course activities on Monday and that you will not have to hurry your departure on Friday.

Information about local travel, transportation, and local hotels is enclosed for your assistance. We believe that you will wish to make your own hotel or motel reservations.

We look forward to seeing you at the course, and we will do everything in our power to make this course a pleasant and rewarding experience for you.

Sincerely yours,

(signature)
Course Coordinator

Note: If something develops which makes it impossible for you to attend the course, please telephone (number) or write this office immediately, in order that another applicant may be admitted to the course in your place. Please do not arrange for a substitute without first getting the approval of this office.

(SAMPLE STANDBY LETTER)

(Institutional Letterhead)

(Date)

To

Dear (Name):

We have received your application for admission to the course "Effluent Monitoring Procedures: Nutrients" to be conducted at (name of institution) during the period (date to date).

We would be most pleased to enroll you in this course, but by the time we received your application, all available positions in the class had been reserved. As you may know, we limit the class size to a fixed number in order to provide for the greatest possible amount of personal instruction during the course, and to provide each participant with the greatest possible opportunity for actual practice in the laboratory.

We have made a tentative reservation for you in the next offering of the course, which is scheduled to be given (dates). If this will be satisfactory to you, please write or call us within (number) days, so that we can confirm your reservation.

In the meantime, we have placed your name on the waiting list for the course dates which you requested. If a vacancy does become available, we will let you know immediately.

Sincerely yours,

(signature)
Course Coordinator

(SAMPLE LETTER OF REFERRAL)

(Institutional Letterhead)

(Date)

To

Dear (Name):

We have received your application for admission to the course "Effluent Monitoring Procedures: Nutrients," to be conducted at (name of institution) during the period (date to date).

Based on our review of your previous laboratory experience, we consider that it would be very doubtful whether this course would provide you with all the knowledge and skills you will require to perform the self-monitoring tests and measurements on your municipal wastewater effluents.

Accordingly, we are confirming your reservation in this course, subject to your first satisfactorily completing the course (title of "Basic Skills" course). This course will be conducted at (location) (dates). We have made a tentative reservation for you to attend this course. Please let us know if you can attend this offering of the course.

If you must delay taking the course (name of "Basic Skills" course) at this time, then it will be necessary to delay your acceptance in the course which you have requested.

In the course (name of "Basic Skills" course) you will learn many things not covered in the later course, including use of the analytical balance, preparation and standardization of laboratory reagents, care and maintenance of laboratory supplies and equipment, and related tasks.

We are most anxious to help you learn to perform all the tasks required for self-monitoring of your municipal wastewater effluents. Please let us know if you can come to both courses.

Sincerely yours,

(signature)
Course Coordinator

(SAMPLE LETTER OF WELCOME)

(Institutional Letterhead)

(Date)

TO: COURSE PARTICIPANTS --

We are looking forward to your participation in the course "Effluent Monitoring Procedures: Nutrients", scheduled for presentation at this Center during the period (date to date). If you find you cannot attend the course, please call us (telephone number).

To assist your planning and preparation for this course, the following items are enclosed:

1. List of hotels and motels

2. Information on local bus transportation and city map, (NOTE: If bus service is used to the Center, you must have exact fare of (amount) on on boarding bus).

On your arrival in the classroom you will be provided a course manual and related materials. Production schedules make it impossible to mail manuals to you in advance of course date.

The course will start at 8:30 AM on Monday, (date) in (room identification) and will close no later than 12:30 PM, Friday, (date). At the conclusion of the course, a certificate will be awarded verifying which analytical measurements you have performed in a satisfactory manner. Please arrange your travel schedule for after closing exercises. (Approximately (number) hours should be allowed for travel from (name of institution) to the airport.)

This course involves a considerable amount of work in the laboratory, using concentrated acids and bases. You will want to bring appropriate clothing.

(Name), of our staff, is serving as Course coordinator and will be available to assist you in solving any special problems you encounter while attending the course.

Should you have questions or desire assistance in any way, please do not hesitate to contact us.

Sincerely yours,

(signature)
Director
Institution Name

(EXAMPLE INFORMATION SHEET)

DOWNTOWN HOTELS

CINCINNATIAN HOTEL
6th & Vine Sts.
Cincinnati, Ohio 45202

Phone: 513/241-0180

Single $6.45
Double 8.60
Twin 10.75

225 Rooms
Meeting Room 1 - Capacity 25
TV, restaurant adjoining

NETHERLAND HILTON HOTEL
35 W. 5th Street
Cincinnati, Ohio 45202

Phone: 513/621-3800

Single $22.00
Double 30.00
Twin 34.00

Family plan, 800 rooms, TV, meeting rooms 15 - Cap. 70-1500, special Gov't. rates - $16.00 single, $23.00 double, $24.00 - twin.

TERRACE HILTON HOTEL
15 W. 6th Street
Cincinnati, Ohio 45202

Phone: 513/381-4000

Single $23.00
Double 31.00
Twin 35.00

Family plan, 350 rooms, meeting rooms 4 - cap. 75-400, color TV, special Gov't. rates - $18.00 single, $25.00 double, $26.00 - twin.

STOUFFER's CINCINNATI INN
150 W. 5th Street
Cincinnati, Ohio 45202

Phone: 513/721-8600

Single $25.00 - 28.00
Double 31.00 - 34.00
Twin 31.00

462 rooms, meeting rooms 11, cap. 50-550, swimming pool, cocktail lounge, sauna bath, color TV, Gov't. rates - $20.00 single, $26.00 double.

HOLIDAY INN*
8th & Linn Sts.
Cincinnati, Ohio 45203

Phone: 513/241-8660

Single $22.00
Double 28.00

245 rooms, meeting rooms 4 - cap. 25-135 swimming pool, TV, 2 dining rooms, and bars, night club "Top of the Inn" (entertainment nightly).

NOTE: We recommend you checking the rate at the time you make your reservation in the event there has been a price increase.

These hotels and motels are listed for your information to assist you in planning for your accommodations during your stay in Cincinnati while attending our training course, and does not imply endorsement by the Office of Water Program Operations, U.S. Environmental Protection Agency.

* REQUIRES TRANSFER TO SECOND BUS.

BUS SCHEDULE (EXAMPLE INFORMATION SHEET)

BUS NO. 53 - AUBURN/CLIFTON

BUS NO. 78 - LOCKLAND/READING

BUS. NO. 53

Leave Sixth & Vine	Arrive St. Clair & Vine
AM	AM
7:18	7:36
7:41	7:59
8:03	8:21
8:25	8:43
8:46	9:04

BUS NO. 78

Leave Sixth & Vine	Arrive St. Clair & Vine
AM	AM
7:09	7:22
7:27	7:40
7:44	7:57
8:04	8:17
8:40	8:53

BUS NO. 53

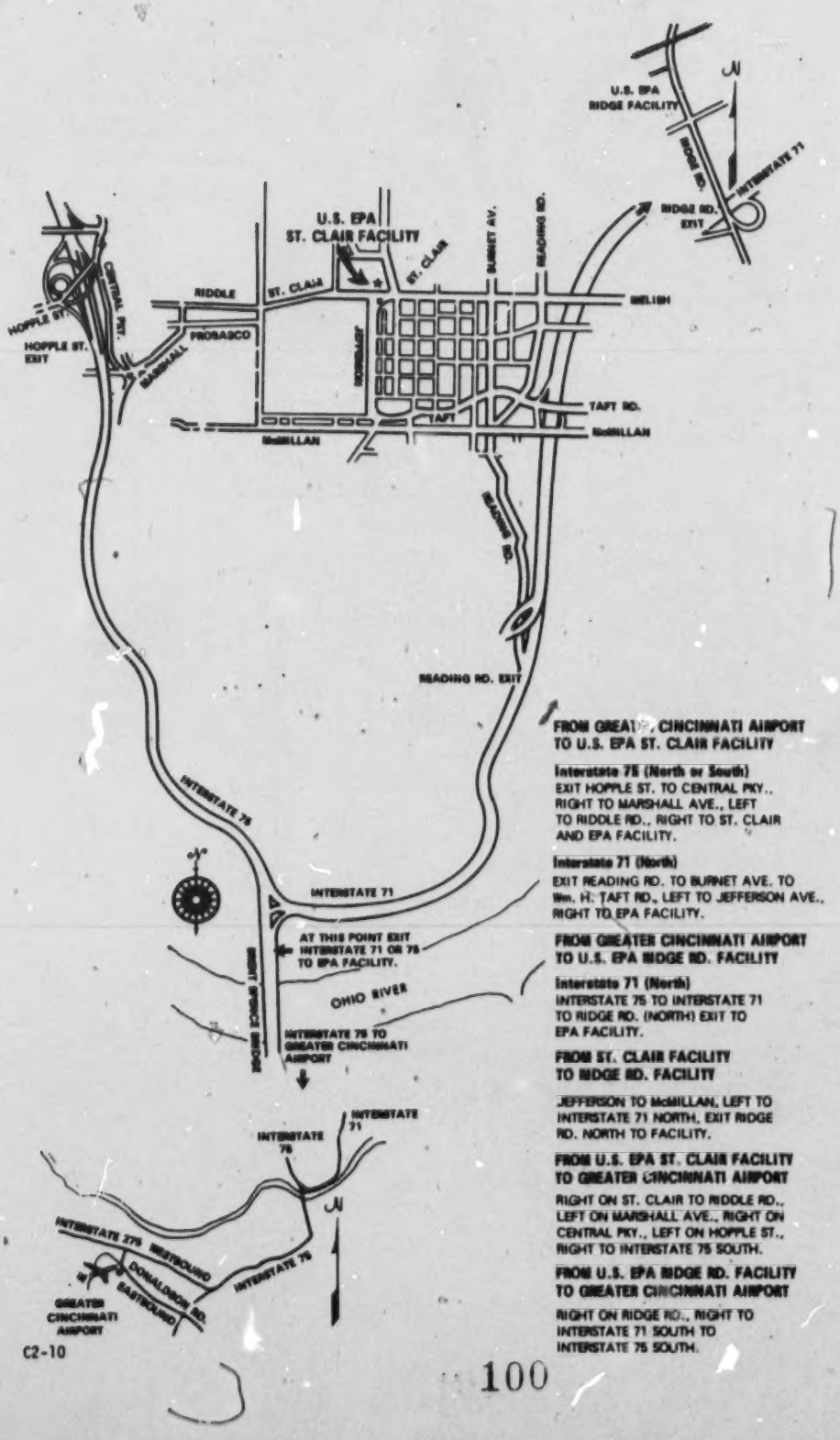
Leave St. Clair & Vine	Arrive Sixth & Vine
PM	PM
12:30	12:48
1:02	1:20
1:33	1:51
2:05	2:23
2:36	2:54
2:58	3:16
3:21	3:39
3:41	4:02
4:04	4:25
4:28	4:49
4:52	5:13

BUS NO. 78

Leave St. Clair & Vine	Arrive Sixth & Vine
PM	PM
12:08	12:24
12:29	12:45
12:50	1:06
2:54	3:12
3:11	3:29
3:28	3:46
3:45	4:03
4:01	4:19
4:17	4:35
4:27	4:51
4:49	5:07

NOTE: The above two routes are the most direct routes to the Environmental Research Laboratory, 26 W. St. Clair Street, Cincinnati, Ohio. Information has been provided by the Queen City Metro. Times selected are those most apt to be used by students attending NTC Training Courses. Arrival times are approximate, and will vary because of road and traffic conditions.

(EXAMPLE INFORMATION SHEET)



FROM GREATER CINCINNATI AIRPORT TO U.S. EPA ST. CLAIR FACILITY

Interstate 75 (North or South)
EXIT HOPPLE ST. TO CENTRAL PKY., RIGHT TO MARSHALL AVE., LEFT TO RIDDLE RD., RIGHT TO ST. CLAIR AND EPA FACILITY.

Interstate 71 (North)
EXIT READING RD. TO BURNET AVE. TO Wm. H. TAFT RD., LEFT TO JEFFERSON AVE., RIGHT TO EPA FACILITY.

FROM GREATER CINCINNATI AIRPORT TO U.S. EPA RIDGE RD. FACILITY

Interstate 71 (North)
INTERSTATE 75 TO INTERSTATE 71 TO RIDGE RD. (NORTH) EXIT TO EPA FACILITY.

FROM ST. CLAIR FACILITY TO RIDGE RD. FACILITY

JEFFERSON TO McMILLAN, LEFT TO INTERSTATE 71 NORTH, EXIT RIDGE RD. NORTH TO FACILITY.

FROM U.S. EPA ST. CLAIR FACILITY TO GREATER CINCINNATI AIRPORT

RIGHT ON ST. CLAIR TO RIDDLE RD., LEFT ON MARSHALL AVE., RIGHT ON CENTRAL PKY., LEFT ON HOPPLE ST., RIGHT TO INTERSTATE 75 SOUTH.

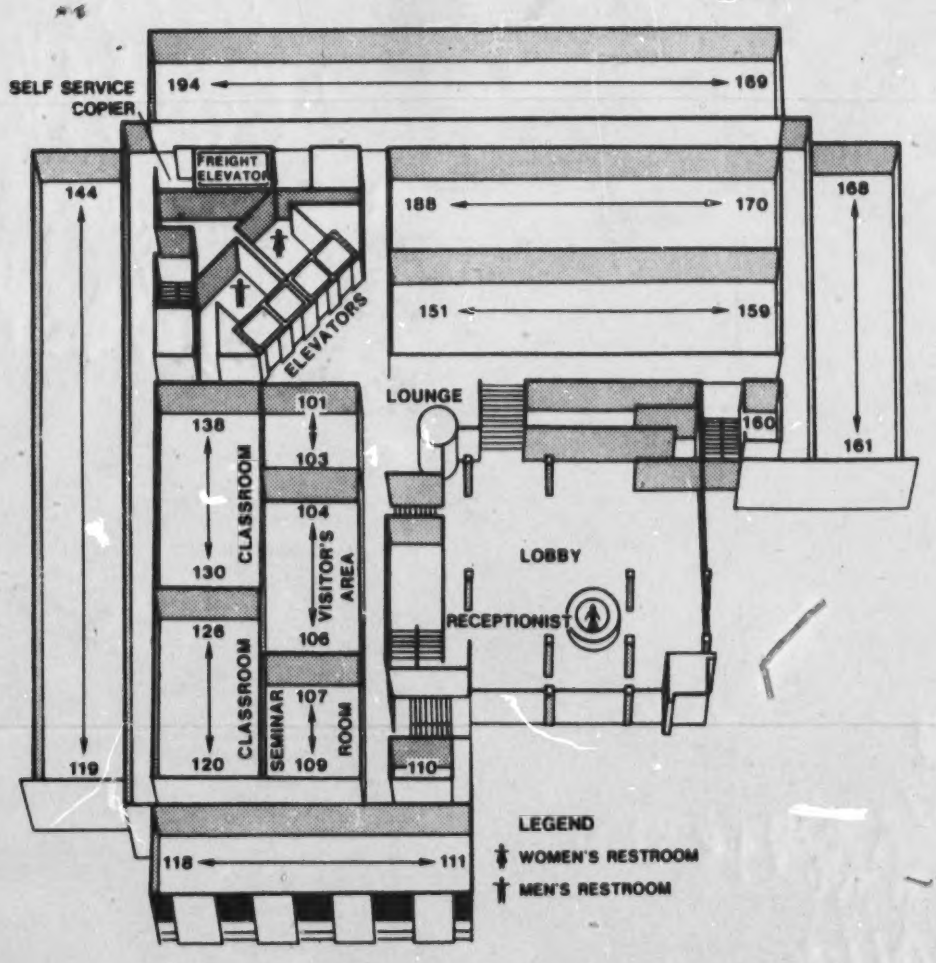
FROM U.S. EPA RIDGE RD. FACILITY TO GREATER CINCINNATI AIRPORT

RIGHT ON RIDGE RD., RIGHT TO INTERSTATE 71 SOUTH TO INTERSTATE 75 SOUTH.

C2-10

12-15

(EXAMPLE INFORMATION SHEET)



First Floor

(SAMPLE REGISTRATION SUMMARY)

_____

(Course Title)

_____

R E G I S T R A T I O N

INDIVIDUAL	WORD REC'D.	APPL. REC'D.	ACCEPT. SENT	COURSE INFO. SENT

(SAMPLE WAITING LIST SUMMARY)

WAITING LIST

INDIVIDUAL	WORD REC'D	APPL. REC'D	ACTION TAKEN

(SAMPLE NON-ATTENDANCE SUMMARY)

_____

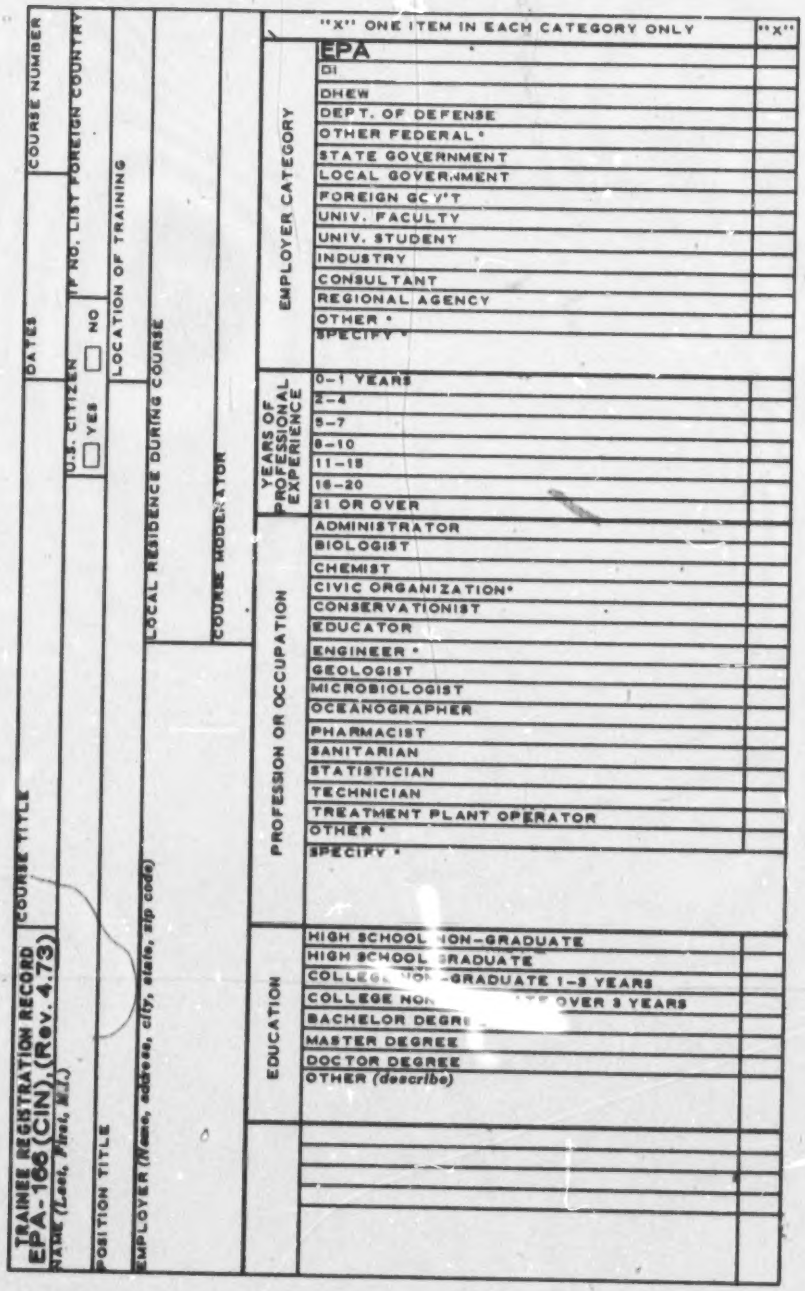
Course Title

_____

Dates

Not Admitted
Lack of Space _____ No Shows _____

(EXAMPLE REGISTRATION CARD)



TRAINEE REGISTRATION RECORD
EPA-166 (CIN), (Rev. 4.73)

NAME (Last, First, M.I.)

POSITION TITLE

EMPLOYER (Name, address, city, state, zip code)

COURSE TITLE

DATES

COURSE NUMBER

U.S. CITIZEN ☐ YES ☐ NO

IF NO, LIST FOREIGN COUNTRY

LOCATION OF TRAINING

LOCAL RESIDENCE DURING COURSE

COURSE MODALITY

"X" ONE ITEM IN EACH CATEGORY ONLY — "X"

EMPLOYER CATEGORY
- EPA
- DI
- DHEW
- DEPT. OF DEFENSE
- OTHER FEDERAL *
- STATE GOVERNMENT
- LOCAL GOVERNMENT
- FOREIGN GOV'T
- UNIV. FACULTY
- UNIV. STUDENT
- INDUSTRY
- CONSULTANT
- REGIONAL AGENCY
- OTHER *
- SPECIFY *

YEARS OF PROFESSIONAL EXPERIENCE
- 0–1 YEARS
- 2–4
- 5–7
- 8–10
- 11–15
- 16–20
- 21 OR OVER

PROFESSION OR OCCUPATION
- ADMINISTRATOR
- BIOLOGIST
- CHEMIST
- CIVIC ORGANIZATION*
- CONSERVATIONIST
- EDUCATOR
- ENGINEER *
- GEOLOGIST
- MICROBIOLOGIST
- OCEANOGRAPHER
- PHARMACIST
- SANITARIAN
- STATISTICIAN
- TECHNICIAN
- TREATMENT PLANT OPERATOR
- OTHER *
- SPECIFY *

EDUCATION
- HIGH SCHOOL NON-GRADUATE
- HIGH SCHOOL GRADUATE
- COLLEGE NON-GRADUATE 1–3 YEARS
- COLLEGE NON-GRADUATE OVER 3 YEARS
- BACHELOR DEGREE
- MASTER DEGREE
- DOCTOR DEGREE
- OTHER *(describe)*

COURSE SUMMARY RECORD *EPA 165 (CIN). (Nov. 7.73)*

ITEM	TALLY	TOTAL
EMPLOYER CATEGORY		
EPA		
DI.		
DHEW		
DEPT. OF DEFENSE		
OTHER FEDERAL		
STATE		
LOCAL		
FOREIGN GOV'T		
UNIV. FACULTY		
UNIV. STUDENT		
INDUSTRY		
CONSULTANT		
REGIONAL AGENCY		
OTHER		
YEARS OF PROFESSIONAL EXPERIENCE		
0-1 YEARS		
2-4		
5-7		
8-10		
11-15		
16-20		
21 OR OVER		
PROFESSION OR OCCUPATION		
ADMINISTRATOR		
BIOLOGIST		
CHEMIST		
CIVIC ORG.		
CONSERVATIONIST		
EDUCATOR		
ENGINEER		
GEOLOGIST		
MICROBIOLOGIST		
OCEANOGRAPHER		
PHARMACIST		
SANITARIAN		
STATISTICIAN		
TECHNICIAN		
TREAT PLANT OPER		
EDUCATION		
HS NON-GRAD		
HS GRAD		
COL 1-3 YEARS		
COL OVER 3 YEARS		
BACHELOR DEGREE		
MASTER DEGREE		
DOCTOR DEGREE		
EPA		
PAID		

BY STATE OR COUNTRY OF EMPLOYMENT AREA	TALLY	TOTAL
ALABAMA		
ALASKA		
ARIZONA		
ARKANSAS		
CALIF.		
COLO.		
CONN.		
DELAWARE		
D. C.		
FLORIDA		
GEORGIA		
HAWAII		
IDAHO		
ILLINOIS		
INDIANA		
IOWA		
KANSAS		
KY.		
LA.		
MAINE		
MD.		
MASS.		
MICHIGAN		
MINN.		
MISS.		
MISSOURI		
MONTANA		
NEBRASKA		
NEVADA		
N. H.		
N. J.		
N. MEXICO		
NEW YORK		
N. C.		
N. D.		
OHIO		
OKLA.		
OREGON		
PENN.		
R. I.		
S. C.		
S. D.		
TENN.		
TEXAS		
UTAH		
VERMONT		
YIRGINIA		
WASH.		
W. VA.		
WISC.		
WYOMING		

LOCATION OF TRAINING

COURSE DIRECTOR

COURSE TITLE

COURSE MODERATOR

DATES

NO. OF TRAINEES

COURSE NUMBER

12-22

(INSTITUTIONAL IDENTIFICATION)

APPROPRIATE

LOGO

This certifies that

THOMAS JONES

has completed the course

Effluent Monitoring Procedures: Metals (164.2)

and has performed the following determinations in a satisfactory manner:

Determination of Calcium

INSTRUCTOR

Determination of Lead

INSTRUCTOR

Determination of Beron

INSTRUCTOR

Determination of Mercury

INSTRUCTOR

Determination of Copper, Magnesium, Manganese and Zinc

INSTRUCTOR

Determination of Sodium and Potassium

INSTRUCTOR

_____, 19___ to _____, 19 ___

SIGNATURE

Director, (Institution Name)

SIGNATURE

Course Coordinator

(EXAMPLE CERTIFICATED)

PART II INSTRUCTIONAL PACKAGE WORKSHEETS

For each Effluent Monitoring Procedure (commonly termed "EMP" by Instructors) in the Student Reference Manual, there is an Instructional Package Worksheet (IPW) in this Guide. The Worksheet is for guidance to the Instructor for development of the subject matter covered in the course.

These Worksheets are not scripts. The Instructor will need to make extensive and detailed preparation in order to perform the assigned tasks effectively and efficiently. The Instructional Packages do provide a perspective on the background of each analytical procedure, lesson-by-lesson learning achievement levels the students should attain, an indication of available audiovisual and other instructional resources, and a recommended course of action in pre-course preparation and classroom/laboratory instruction.

Application of these Instructional Packages will help the Instructor to reduce the time required for planning and organizing a strategy of preparation and instruction. But time and effort are required for physical preparations for classroom and laboratory instruction; time and effort are required for rehearsals of Instructor performance in classroom and laboratory. These requirements never can be met by such a Course Guide as this; ultimately the Instructor is the key person in assuring that the student acquires the needed knowledge and skills.

A PROTOTYPE FOR DEVELOPMENT OF
ROUTINE OPERATIONAL PROCEDURES

for the

DETERMINATION OF BORON, CURCUMIN METHOD

as applied in

WASTEWATER TREATMENT FACILITIES
and in the
MONITORING OF EFFLUENT WASTEWATERS

INSTRUCTIONAL PACKAGE WORKSHEET

National Training and Operational Technology Center
Municipal Operations and Training Division
Office of Water Program Operations
U.S. Environmental Protection Agency

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PART II INSTRUCTIONAL PACKAGE WORKSHEET

A. Determination of Boron, Curcumin Method

1. This method is the only acceptable method listed in the Federal Register.

2. The reference used is from the 14th Edition of Standard Methods for the Examination of Water and Wastewater, 1975 page 287.

3. Student will prepare one blank, one calibration standard and carry them through the procedure with one unknown sample prepared by the instructor.

GUIDELINES FOR
INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Determination of Boron, Curcumin Method

UNIT OF INSTRUCTION: Summary of 3 Elements

ESTIMATED TIME: 240 minutes

JUSTIFICATION FOR THIS INSTRUCTIONAL OBJECTIVE: Many National Pollution Discharge Elimination System Permits require the determination of boron or else of metals using similar colorimetric procedures.

ENTRY LEVEL BEHAVIOR: The learner must have skills equivalent to those in the Level I Course, Basic Laboratory Skills. He must also know how to use a spectrophotometer and how to construct a calibration graph.

A. INSTRUCTIONAL OBJECTIVE:

1. Terminal Behavior: The learner will locate and scan Procedures A, B, C and D which give directions for preparing to test the sample. Then he will record sample identification information, prepare a blank and at least one standard, measure out sample, treat each solution to develop color, filter the sample, obtain and post absorbance readings for his solutions, construct a calibration curve from class results, use this curve and his absorbance value for the sample to find its boron concentration, submit his graph and completed data sheet to the instructor, and participate in a summary session on Procedure J and conditions critical to the test, all according to the Procedures in the EMP.

2. Conditions: He will be given the EMP, classroom instruction, copies of the EMP data sheet and calibration graph form, cleaned equipment, the required reagents, a sample, absorbance values from the class, and total working time of 200 minutes

3. Accepted Performance: His techniques must conform to those described in the EMP according to an instructor's rating. In addition, his answer must agree within ± 0.02 mg/liter of the class average unless some explanation of the disagreement is accepted by the instructor.

B. INSTRUCTIONAL RESOURCES:

1. Available Media: "Standard Methods for the Examination of Water and Wastewater," 1976 EPA "Methods for Chemical Analysis of Water and Wastes," 1974; EMP, "Determination of Boron, Curcumin Method;" copies of the EMP Data Sheet and Calibration Graph; overheads (4) of the EMP Flow Sheet, EMP Data Sheet, EMP Calibration Graph and a List of Three Conditions Critical to Test Accuracy.

2. Suggested Media: None

C. INSTRUCTIONAL APPROACH:

1. Preparation for Instruction:

a. Duplicate copies for the students of the EMP data sheet and calibration graph. (OPTION: Two completed sheets of each will be required for each student--one for him and one for the record. You can distribute 1 data sheet and 1 graph form and later duplicate the completed sheets submitted by the student. Alternatively, you can distribute 2 of each sheet and have the student make copies.)

b. Check the water bath for consistency of test temperature (55 ± 2°C).

c. Check evaoporating dishes for uniformity of size and composition. They must be clean and free of scratches.

d. Check on the number of evaporating dishes your water bath(s) can hold. One dish requires about 5 square inches of space. Decide how many are available per student during the test. Plan assignment of standards accordingly.

e. Plan the table needed on the chalk board for students to post absorbance results.

f. Make out tags for the sample bottles (1 per 3 students) including the information required for the EMP Data Sheet.

g. Obtain or plan to prepare a sample (1.0 ml per student) with boron concentration between 0.1 to 1.00 mg/liter. Sample dilutions extend this range of applicability.

h. See that the equipment and reagents required for each student to do the planned "Student Performances" are prepared and assembled in the laboratory.

2. Sequencing:

a. Lesson one - 195 minutes

This time includes 80 + minutes for an evaporation process. Students should periodically observe the test solutions during evaporation but they can work in a 20 minute break during that process.

b. No Break

(Alternative: There can be a break of indefinite length before the next lesson on constructing the calibration curve).

c. Lesson two - 25 minutes

d. No Break

(Alternative: There can be a break of indefinite length before the final summary lesson.)

e. Lesson three - 20 minutes

D. IPW EQUIPMENT AND SUPPLY REQUIREMENTS
(1 blank, 1 standard, 1 sample)

1. For Each Student:

a. 1 beaker, 50 ml
b. 3 dishes, evaporating, porcelain, 100 ml, equal diameters
c. 1 long dropper, 1-2 ml with bulb
d. 1 piece filter paper, Whatman No. 30, to fit funnel
e. 3 flasks, volumetric, 25 ml, with stoppers
f. 2 flasks, volumetric, 100 ml, with stoppers
g. 1 funnel, fluted, 60°, 40 mm diameter, 50 mm stem length
h. 1 glass rod, short
i. 1 pipet, measuring, Mohr, 10 ml
j. 3 pipets, volumetric, 1 ml
k. 1 pipet, volumetric, 4 ml
l. 1 propipet or pipet bulb
m. 1 stirring rod (policeman), polyethylene, about 6 inch length
n. 1 support, ring stand with small ring
o. 1 triangle, clay (for filter funnel)
p. 2 wash bottles, polyethylene squeeze type (one for alcohol, one for water)
q. 1 wax pencil

2. Shared:

a. 1 set of volumetric pipets (2, 5, 8 and 10 ml) per 4 students

b. 1 sample bottle, tagged, per 3 students (polyethylene or alkali-resistant, boron-free glassware)

c. 1 spectrophotometer per 3 students for use at 540 nm, with cell(s), minimum path length of 1 cm; box of lint-free tissues by each instrument and container for wastes

d. 1 thermometer, degrees C, per water bath

e. X water bath(s), constant temperature to maintain 55 $\pm$ 2°C. Number required depends on size of bath and planned student assignment. (Each 100 ml evaporating dish requires about 5 square inches of space.)

E. IPW REAGENT REQUIREMENTS:
(minimum amounts per student)

300 ml distilled water, boron-free

12 ml curcumin reagent (95% ethyl alcohol, curcumin, oxalic acid, concentrated hydrochloric acid)

100 ml 95% ethyl alcohol

100 ml stock boron solution (For accuracy in preparation, it is convenient to make 1 liter of this solution. In turn, 100 ml of stock is required for 1 liter of standard solution.)

25 ml standard boron solution--Prepare fresh on day of use. (For accuracy, it is convenient to make 1 liter of this solution.)

1 ml sample with boron concentration between 0.1 to 1.00 mg/liter (It is convenient to dilute say 20 ml of standard boron solution to 500 ml to give a concentration of 0.4 mg/liter so sample absorbance falls below the midpoint of the calibration curve.)

GUIDELINES FOR
INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Determination of Boron, Curcumin Method

UNIT OF INSTRUCTION: Procedure A, Preparing to Test the Sample (with references to Procedures B, C and D); Procedure E, Preparation of Standards; Procedure F, Color Development of Standards and Sample; Procedure G, Removal of Cationic Interferences from the Sample(s) and Procedure H, Spectrophotometric Measurements

LESSON: 1 of 3

ESTIMATED TIME: 195 minutes

JUSTIFICATION FOR THIS INSTRUCTIONAL OBJECTIVE: The learner must perform these procedures in order to determine boron concentrations in samples.

ENTRY LEVEL BEHAVIOR: The learner must have skills equivalent to those in the Level I Course, Basic Laboratory Skills, and he must know how to use a spectrophotometer.

A. INSTRUCTIONAL OBJECTIVE:

1. Terminal Behavior: The learner will locate and scan Procedures A, B, C and D which give directions for preparing to test the sample. Then he will record sample identification information, prepare a blank and at least one calibration standard and measure an aliquot of sample, treat each solution with curcumin reagent and evaporate to dryness to develop a colored product (rosocyanine), dissolve the product in alcohol, filter the sample solution, and measure absorbances of all processed solutions, keeping indicated records and performing all according to EMP Procedures E, F, G and H.

2. Conditions: He will be given classroom instruction, the EMP, a copy of the EMP data sheet, the required equipment cleaned and ready to use (Procedures B & C), the required reagents (Procedure D), minimal supervision and total working time of 175 minutes.

3. Accepted Performance: His techniques must conform to those described in the EMP according to an instructor's rating. (Particularly note if he checks evaporating dishes before use, uses correct pipetting techniques and observes the evaporation process.)

B. INSTRUCTIONAL RESOURCES:

1. Available Media: EMP, overheads (2) of EMP Flow Sheet and EMP Data Sheet, copies of EMP Data Sheet

2. Suggested Media: None

C. INSTRUCTIONAL APPROACH:

1. Presentation: (20 minutes)

a. Introduction - Training Guide I

b. Overview of test - use overhead of EMP Flow Sheet

c. Procedure A
   (1) Go through A, steps 1-4 to note references to and locations of EMP Procedures B, C, D. Any instructional remarks about these Procedures can be made at this time.

   (2) A, step 5 - Disbribute copies of EMP "Example Laboratory Data Sheet." Use overhead of same to note the format with step designations in left column. Use A 5 and A 6 as examples of using the sheet with the EMP.

   (3) A, step 7 - Note students will begin with Procedure E, Preparation of Standards.

d. Procedure E
   (1) Read through E, step 1 to note the division of this procedure for establishing or checking the calibration curve.

   (2) E, step 2 - assign a blank and at least one standard to each student. Announce that they will post results so class can construct a calibration curve.

e. Procedure F
   (1) Read through F, step 1 to note the division of this procedure for establishing or checking the calibration curve.

   (2) F, step 2 - Go through the notes about the evaporating dishes.

   (3) F, step 3 - Note small volume (1.0 ml) to be measured. Remind class to use clean, dry pipet for each, wiping excess off outside of pipet, care in adjusting meniscus.

   (4) F, step 9 - Assignment: All are to do the sample. If dilutions are planned, assign them now.

   (5) F, step 14 - Breaks: Each can take breaks here but each should observe the progress of the evaporation and the appearance of the product when dry.

   (6) F, step 15 - note 15b

   (7) F, step 36 - note 36b

f. Procedure G
   Assignment: All are to do all of Procedure G.
   (1) G, step 6 - note 6a

g. Procedure H
   Assignment: All are to do all of Procedure H.

2. Student Performance and Evaluation: (175 minutes)

   As stated in the Instructional Objective above

GUIDELINES FOR
INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Determination of Boron, Curcumin Method

UNIT OF INSTRUCTION: Procedure I, Making a Calibration Curve and Procedure K, Finding the Concentration of Boron, mg/liter for the Sample(s)

LESSON: 2 of 3

ESTIMATED TIME: 25 minutes

JUSTIFICATION FOR THIS INSTRUCTIONAL OBJECTIVE: This colorimetric procedure requires a calibration curve to determine concentrations of boron.

ENTRY LEVEL BEHAVIOR: The learner must know how to construct and use a calibration graph.

A. INSTRUCTIONAL OBJECTIVE:

1. Terminal Behavior: The learner is to post his absorbance results, participate in a discussion of the posted class results, construct a calibration graph from the set of absorbances chosen by the class, use this curve and his absorbance value for the sample to determine the concentration of boron, record the result on the data sheet and submit the graph and the completed data sheet to the instructor, all according to EMP Procedures I and K.

2. Conditions: He will be given the EMP, a copy of the EMP Calibration Graph Form, absorbances from the class, minimal supervision and total working time of 10 minutes plus 5 minutes in group session.

3. Accepted Performance: His work is to conform to the instructions in the EMP and his concentration for the sample must agree within ± 0.02 mg/liter of the class average unless some explanation of the disagreement is accepted by the instructor.

B. INSTRUCTIONAL RESOURCES:

1. Available Media: EMP, overhead (1) of EMP Calibration Graph, copies of graph

2. Suggested Media: None

C. INSTRUCTIONAL APPROACH:

1. Group Session: (10 minutes)

a. Have students post absorbance results for their standard and sample.

b. With class, choose a set of absorbance values to be used to construct a calibration curve.

c. Read through I, step 1 to note location of procedures for checking or establishing a calibration curve.

d. Note Procedure K on using the calibration curve.

e. Distribute copies of EMP Calibration Graph Form. You may want to use the overhead of same to remind students how to construct a graph and how to use it to get a concentration value for a sample.

2. Student Performance and Evaluation: (15 minutes)

As stated in the Instructional Objective above.

3. NOTE: Collect the graphs and completed data sheets.

GUIDELINES FOR
INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Determination of Boron, Curcumin Method

UNIT OF INSTRUCTION: Procedure J, Checking the Calibration Curve and a Summary of Conditions Critical to the Test.

LESSON: 3 of 3

ESTIMATED TIME: 20 minutes

JUSTIFICATION FOR THIS INSTRUCTIONAL OBJECTIVE: The learner must know how to check his calibration curve and should be alert to conditions critically affecting test results.

ENTRY LEVEL BEHAVIOR: The learner must have performed the determination of boron, using the EMP provided.

A. INSTRUCTIONAL OBJECTIVE:

1. Terminal Behavior: The learner is to participate in a summary session on critical conditions of the test and learn the procedure for checking calibration curves.

2. Conditions: He will have the EMP and any notes he made and a total time of 10 minutes.

3. Accepted Performance: Active participation in the session as judged by the instructor.

B. INSTRUCTIONAL RESOURCES:

1. Available Media: EMP and overhead (1) of conditions critical to test accuracy.

2. Suggested Media: None

C. INSTRUCTIONAL APPROACH:

1. Discussion: (10 minutes)

a. If time between lesson 2 and 3 permitted the instructor to correct the data sheets, return them now and make any comments of general interest. If sheets are not ready for return, announce that instructor will do so as soon as possible.

b. Use overhead and the EMP to emphasize conditions critical to accurate performance of the test:

(1) temperature for evaporation - F, step 14 Notes a and b
(2) length of drying time - F, step 14 Notes e and f
(3) effect of evaporating dish characteristics - F, step 2 and H step 4 notes

c. Note information on diluting samples - F, step 10 notes

d. Briefly go through Procedure J, "Checking the Calibration Curve:"

(1) Recall when a check is used - E Note 1a

(2) Note acceptable range for check - J Note 5a

2. Student Performance and Evaluation: (10 minutes)

As stated in Instructional Objective above.

A PROTOTYPE FOR THE DEVELOPMENT OF ROUTINE OPERATIONAL PROCEDURES

for the

VOLUMETRIC DETERMINATION OF TOTAL CALCIUM

as applied in

WASTEWATER TREATMENT FACILITIES
and in the
MONITORING OF EFFLUENT WASTEWATERS

Instructional Package Worksheet

National Training and Operational Technology Center
Municipal Operations and Training Division
Office of Water Program Operations
U.S. Environmental Protection Agency

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PART II INSTRUCTIONAL PACKAGE WORKSHEETS

B. Determination of Total Calcium (Volumetric Method)

1. The Federal Register lists an alternate procedure by Atomic Absorption. This reference can be found in Standard Methods for the Examination of Water and Wastewater 14th Edition, 1975 page 148.

2. The volumetric procedure was selected since it can be performed with inexpensive, readily available, conventional laboratory glassware. If a laboratory is equipped with atomic absorption instrumentation, the atomic absorption method would be preferred.

3. Student will prepare calcium stock and standard solutions and standardized EDTA solution. Student will digest, titrate and calculate the result of the analysis of a sample prepared by the instructor.

GUIDELINES FOR
INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Volumetric Determination of Total Calcium

UNIT OF INSTRUCTION: Summary of Three Elements
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ESTIMATED TIME: Five Hours

JUSTIFICATION FOR THIS INSTRUCTIONAL OBJECTIVE: The reporting of Total Calcium is required by many National Pollutant Discharge Elimination System Permits.

ENTRY LEVEL BEHAVIOR: The learner must have completed Course I, Basic Laboratory Skills or have shown competence in the areas covered by this course. Course II is not a prerequisite, but is desirable. The learner must also be able to perform the following:

1. Adjust pH of sample
2. Use an analytical balance

A. INSTRUCTIONAL OBJECTIVE

1. Terminal Behavior - The learner will perform all laboratory work and calculate results.

2. Conditions - The learner will have available all necessary glassware, reagents, and equipment along with a copy of Volumetric Determination of Total Calcium Effluent Monitoring Procedure.

3. Accepted Performance - Given a checklist to be kept by the Instructor, the student will obtain 80%. He will also repeat the analysis until 80% is accomplished.

B. INSTRUCTIONAL RESOURCES:

1. Available Media: Volumetric Determination of Total Calcium Effluent Monitoring Procedure. 1974 EPA Methods of Chemical Analysis, page 175.

2. Suggested Media: Overheads showing digestion of sample

C. INSTRUCTIONAL APPROACH: (Sequencing) Theoretical concepts of EDTA Titrimetric method to be discussed in the classroom. Procedure description to include the digestion techniques and pH adjustment to the sample. Analyses which includes student performance as well as instructor evaluation. IPW Equipment and Supply Requirements - see page 2-5, part A of Effluent Monitoring Procedure. IPW Reagent Requirements - see page 2-5, part C of Effluent Monitoring Procedure.

GUIDELINES FOR
INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Volumetric Determination of Total Calcium

UNIT OF INSTRUCTION: Theoretical Concepts

LESSON NUMBER: 1 of 3

ESTIMATED TIME: 1 Hour

JUSTIFICATION FOR THIS INSTRUCTIONAL OBJECTIVE: The reporting of Total Calcium is required by many National Pollutant Discharge Elimination System Permits.

ENTRY LEVEL BEHAVIOR: The learner must have completed Course I, Basic Laboratory Skills or have shown competence in the areas covered by this course. Course II is not a prerequisite, but is desirable. The learner must also be able to perform the following:

1. Adjust pH of sample
2. Use an analytical balance

A. INSTRUCTIONAL OBJECTIVE:

1. Terminal Behavior: The learner will participate in classroom discussion.

2. Conditions: The learner will have a copy of the Volumetric Determination of Total Calcium Effluent Monitoring Procedure.

3. Accepted Performance: The learner will answer all questions orally given by the Instructor.

B. INSTRUCTIONAL RESOURCES:

1. Available Media: Volumetric Determination of Total Calcium Effluent Monitoring Procedure. 1974 EPA Methods of Chemical Analysis, Page 175.

2. Suggested Media: None

C. INSTRUCTIONAL APPROACH: (Sequencing) The Instructor should cover the basic chemistry of EDTA titrimetric method of determining calcium. The color changes of the titration should also be emphasized at this time.

GUIDELINES FOR
INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Volumetric Determination of Total Calcium

UNIT OF INSTRUCTION: Procedure Description

ESTIMATED TIME: 30 Minutes

LESSON NUMBER: 2 of 3

JUSTIFICATION FOR THIS INSTRUCTIONAL OBJECTIVE: The reporting of Total Calcium is required by many National Pollutant Discharge Elimination System Permits.

ENTRY LEVEL BEHAVIOR: The learner must have completed Course I, Basic Laboratory Skills or have shown competence in the areas covered by this course. Course II is not a prerequisite, but is desirable. The learner must also be able to perform the following:

1. Adjust pH of sample
2. Use an analytical balance

A. INSTRUCTIONAL OBJECTIVE:

1. Terminal Behavior: The learner will participate in classroom discussion.

2. Conditions: The learner will have a copy of the Volumetric Determination of Total Calcium Effluent Monitoring Procedure.

3. Accepted Performance: The learner will answer all questions orally given by the Instructor.

B. INSTRUCTIONAL RESOURCES:

1. Available Media: Volumetric Determination of Total Calcium Effluent Monitoring Procedure. 1974 EPA Methods of Chemical Analysis, page 175.

2. Suggested Media: Overheads showing digestion and reflux of sample.

C. INSTRUCTIONAL APPROACH (Sequencing) The Instructor should cover the actual procedure as outlined in the EMP beginning on page 2-11. It should be emphasized at this point that the EDTA must be standardized after preparation. The digestion of the sample should be explained. It is also important that the student be made aware that correct pH adjustment of sample is critical to the analysis.

GUIDELINES FOR
INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Volumetric Determination of Total Calcium

UNIT OF INSTRUCTION: Analysis

LESSON NUMBER: 3 of 3

ESTIMATED TIME: 3.5 Hours

JUSTIFICATION FOR THIS INSTRUCTIONAL OBJECTIVE: The reporting of Total Calcium is required by many National Pollutant Discharge Elimination System Permits.

ENTRY LEVEL BEHAVIOR: The learner must have completed Course I, Basic Laboratory Skills or have shown competence in the areas covered by this course. Course II is not a prerequisite, but is desirable. The learner must also be able to perform the following:

1. Adjust pH of sample
2. Use an analytical balance

A. INSTRUCTIONAL OBJECTIVE:

1. Terminal Behavior: The learner will perform the Total Calcium Determination of by the EDTA Volumetric Method.

2. Conditions: The learner will have a copy of the Volumetric Determination of Total Calcium Effluent Monitoring Procedure.

3. Accepted Performance: The student must obtain an 80% on the Instructor checklist or repeat until he does.

B. INSTRUCTIONAL RESOURCES:

1. Available Media: Volumetric Determination of Total Calcium Effluent Monitoring Procedure. 1974 EPA Methods of Chemical Analysis, page 175.

2. Suggested Media: Photo or color slides of an actual endpoint color change.

C. INSTRUCTIONAL APPROACH (Sequencing) Student prepares Calcium Stock and Standard Solutions, as well as EDTA solution. Student standardizes EDTA. Student digests sample. Student titrates sample. Student calculates results.

A PROTOTYPE FOR DEVELOPMENT OF ROUTINE OPERATIONAL PROCEDURES

for the

DETERMINATION OF COPPER (Cu^{++}), MAGNESIUM (Mg^{++}) MANGANESE (Mn^{++}), and ZINC (Zn^{++})

as applied in

WASTEWATER TREATMENT FACILITIES
and in the
MONITORING OF EFFLUENT WASTEWATERS

INSTRUCTIONAL PACKAGE WORKSHEET

National Training and Operational Technology Center
Municipal Operations and Training Division
Office of Water Program Operations
U.S. Environmental Protection Agency

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C. Determination of Copper (Cu++), Magnesium (Mg++) Manganese (Mn++), and Zinc (Zn++)

1. Copper: The Federal Register also provides a colorimetric procedure (Neocuproine Method). This procedure can be found in Standard Methods for the Examination of Water and Wastewater 14th Edition, 1975 page 196.

2. Magnesium: The Federal Register also provides a gravimetric procedure. This procedure can be found in Standard Methods for the Examination of Water and Wastewater 14th Edition, 1975 page 221.

3. Manganese: The Federal Register also provides a colorimetric procedure (Persulfate Method). This procedure can be found in Standard Methods for the Examination of Water and Wastewater 14th Edition, 1975 page 225.

4. Zinc: The Federal Register also provides a colorimetric procedure (Dithizone Method II). This procedure can be found in Standard Methods for the Examination of Water and Wastewater 14th Edition, 1975 page 265.

   a. The atomic absorption technique was chosen to demonstrate the use of this instrument for the analysis of these metals.

   b. The student prepares his own standard solutions, prepares calibration curves and analyses an unknown sample prepared by the instructor.

GUIDELINES FOR
INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Determination of Copper (Cu^{++}), Magnesium (Mg^{++}), Manganese (Mn^{++}), and Zinc (Zn^{++})

UNIT OF INSTRUCTION:

LESSON NUMBER: 1 of 1

ESTIMATED TIME: 3 hours

JUSTIFICATION FOR THIS INSTRUCTIONAL OBJECTIVE: The learner will need to know how to perform this determination if it is required by his permit.

ENTRY LEVEL BEHAVIOR: The learner must be able to:

1. Perform weighings on an analytical balance
2. Perform weighings on a trip or platform balance
3. Correctly use common laboratory glassware such as:
   a. volumetric flasks
   b. pipets and pipetting bulbs
4. Calculate and use dilution factors
5. Prepare solutions of acids safely
6. Handle compressed gas cylinders safely

A. INSTRUCTIONAL OBJECTIVE:

1. Terminal Behavior: The learner will record sample identification information, prepare a blank and series of standards, optimize the atomic absorption instrument, and aspirate the standards and samples. He will clean up his equipment and use the obtained data to determine the concentration of copper, magnesium, manganese and zinc in a sample.
2. Conditions: The learner will be provided with the necessary glassware, reagents, a sample, an atomic absorption instrument and a copy of the EMP.
3. Accepted Performance: The learner's technique must be satisfactory according to an instructor's rating. His calibration curves and obtained results must be within 5 percent of the correct value.

B. INSTRUCTIONAL RESOURCES:

1. Available Media: EPA "Methods for Chemical Analysis of Water and Wastes," 1974; Instruction Manual for the Atomic Absorption Spectrophotometer; XT-26 - Atomic Absorption (tape slide); the EMP "Determination of Copper, Magnesium, Manganese, and Zinc;" TC-29, Atomic Absorption Instrumentation Laboratory Briefing (video cassette).

2. Suggested Media: Overheads showing location of controls of the atomic absorption instrument and theory of atomic absorption.

C. INSTRUCTIONAL APPROACH (Sequencing):

1. Classroom: Using overhead projecturals acquaint the learner with the basic theory of atomic absorption. The tape/slide audio visual unit XT-26 can be used to explain the theory of atomic absorption. Have the students read the sections of the EMP and review the procedure.

2. Laboratory: Supply the learner with all necessary equipment. Have the student optimize the instrument until it is ready for use. Have the student prepare the sample for analysis, prepare calibration curves by aspiration of standards into the instrument, aspirate sample, prepare calibration curves and calculate results.

3. Classroom: Discuss the laboratory performance of the learner.

A PROTOTYPE FOR DEVELOPMENT OF
ROUTINE OPERATIONAL PROCEDURES

for the

DETERMINATION OF LEAD BY ATOMIC ABSORPTION USING THE EXTRACTION PROCEDURE

as applied in

WASTEWATER TREATMENT FACILITIES
and in the
MONITORING OF EFFLUENT WASTEWATERS

INSTRUCTIONAL PACKAGE WORKSHEET

National Training and Operational Technology Center
Municipal Operations and Training Division
Office of Water Program Operations
U.S. Environmental Protection Agency

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PART II INSTRUCTIONAL PACKAGE WORKSHEET

D. Determination of Lead by Atomic Absorption Using the Extraction Procedure

1. The Federal Register lists an alternate procedure (Dithizone Method). This procedure can be found in Standard Methods for the Examination of Water and Wastewater 14th Edition, 1975 page 215.

2. The atomic absorption technique was selected and can be found in Standard Methods for the Examination of Water and Wastewater 14 Edition, 1975 page 148.

3. The student prepares his own standard solutions, prepares calibration curves and analyzes an unknown sample prepared by the instructor.

GUIDELINES FOR

INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Determination of Lead by Atomic Absorption Spectroscopy Using the Extraction Procedure

UNIT OF INSTRUCTION:

LESSON NUMBER: 1 of 1

ESTIMATED TIME: 2.5 hours

JUSTIFICATION FOR THIS INSTRUCTION OBJECTIVE: The learner will be responsible for determining the lead content of wastewater samples for NPDES report requirement.

ENTRY LEVEL BEHAVIOR: The learner must be able to:

1. Perform weighings on an analytical balance
2. Perform weighings on a trip or platform balance
3. Corectly use common laboratory glassware such as
   a) volumetric flasks
   b) separatory funnel
   c) graduated cylinders
   d) pipets and pipetting bulbs
4. Construct and use a graph
5. Transfer solids from a weighing boat to flask
6. Calculate and use dilution factors
7. Prepare solutions of acids safely
8. Handle compressed gas cylinders safely

A. INSTRUCTIONAL OBJECTIVE

1. Terminal Behavior - The learner will record sample identification information, prepare a blank and series of standards, optimize the atomic absorption instrument, and aspirate the standards and samples. He will clean up his equipment and use the obtained data to determine the concentration of lead in the sample.

2. Conditions - The learner will be provided with the necessary glassware, reagents, a sample, an atomic absorption instrument, a copy of the EMP and 105 min.

3. Accepted Performance - The learner's technique must be satisfactory according to an instructor's rating. His calibration curve and obtained results must closely match the instructor's.

B. INSTRUCTIONAL RESOURCES

1. Available Media - EPA "Methods for Chemical Analysis of Water and Wastes," 1974; Instruction Handbook for the Atomic Absorption Spectrophotometer, Instrument Laboratories, Inc. (or equivalent); XT-26 Atomic Absorption (slide sequence); The EMP Determination of Lead by Atomic Absorption Using the Extraction Procedure.

2. Suggested Media - Overheads showing location of controls of the atomic absorption instrument, also overheads dealing with the basic theory of atomic absorption.

C. INSTRUCTIONAL APPROACH (SEQUENCING)

1. Classroom - Using overheads acquaint the student with the basic theory of atomic absorption. Explain the reasons for using the extraction procedure. Using the overheads show the student the operation of the atomic absorption instrument he will be using. The slide sequence XT-26 can be used to explain the theory of atomic absorption. Have the students read the sections of the EMP and go over the operation procedure.

2. Laboratory - Supply the learner with all necessary equipment. Have the student optimize the instrument until it is ready for use. Then have the student extract the sample or samples and series of standards and aspirate the sample and standards.

3. Classroom - Discuss the laboratory performance of the learner.

A PROTOTYPE FOR DEVELOPMENT OF
ROUTINE OPERATIONAL PROCEDURES

for the

DETERMINATION OF MERCURY USING THE FLAMELESS ATOMIC ABSORPTION (COLD VAPOR) TECHNIQUE

as applied in

WASTEWATER TREATMENT FACILITIES
and in the
MONITORING OF EFFLUENT WASTEWATERS

INSTRUCTIONAL PACKAGE WORKSHEET

National Training and Operational Technology Center
Municipal Operations and Training Division
Office of Water Program Operations
U.S. Environmental Protection Agency

CH.MET.aa.ipw.3.8.77

PART II INSTRUCTIONAL PACKAGE WORKSHEET

E. Determination of Mercury Using the Flameless Atomic Absorption (Cold Vapor) Technique

1. The Federal Register recommends the use of the Flameless Atomic Absorption technique for the analysis of mercury. It can be found in Standard Methods for the Examination of Water and Wastewater, 14th Edition, 1975 page 156.

2. The learner will determine the necessary content of several standard solutions and typical samples of treatment plant effluents.

GUIDELINES FOR
INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Mercury Determination

UNIT OF INSTRUCTION: Determination of Mercury Using the Falmeless Atomic Absorption (Cold Vapor) Technique

LESSON NUMBER: 1 of 1

ESTIMATED TIME: 2.5 hours

JUSTIFICATION FOR THIS INSTRUCTIONAL OBJECTIVE: The learner should know how to set-up, calibrate, and use a Coleman MAS-50 Mercury Analyzer for the determination of mercury in wastewater and wastewater treatment plant effluents

ENTRY LEVEL BEHAVIOR: The learner must be able to:

1. Perform basic mathematical computations (addition, subtraction, multiplication, and division)
2. Handle solutions of acids and bases safely
3. Bore holes in rubber stoppers and bend and cut glass tubing safely
4. Understand the terms liter, milliliter, gram, milligram
5. Perform weighings on an analytical and on a trip balance
6. Use ordinary laboratory glassware such as beakers, flasks, graduated cylinders, volumetric flasks, burettes, volumetric and graduated pipettes.
7. Clean laboratory glassware
8. Prepare chemical solutions

A. INSTRUCTIONAL OBJECTIVE
   1. Terminal Behavior - The learner will determine the mercury content of several standard solutions and typical samples of treatment plant effluents.
   2. Conditions - The learner will have the use of the attached EMP and all chemicals and equipment listed in it.
   3. Accepted Performance - The use of proper technique in performing the test will be judged by the instructor.

B. INSTRUCTIONAL RESOURCES
   1. Available Media - EPA "Methods for the Chemical Analyses of Water and Wastes", 1974; Instruction Handbook, on the Coleman Mercury Analyzer MAS-50; the EMP "Determination of Mercury by the Flameless (Cold Vapor) Atomic Absorption Method

2. XT-92 Slide sequence on the method covering both the chemical and spectrophotomatic sections; over heads covering the control locations on the MAS-50 instrument.

C. INSTRUCTIONAL APPROACH (Sequencing)

1. Classroom - Have the students read each section of the EMP. Cover the operation of the instrument. Explain the difference between flameless atomic absorption and the normal operation of atomic absorption. Explain the advantage and disadvantage of each type.

2. Laboratory - Supply the learner with all necessary glassware and reagents. Have the students turn on the instrument in order to begin warm-up. Unless the sample being used is an effluent sample, the heating times can be omitted. Consequently, the students should begin the chemical procedure immediately after turning on the instrument. During the 15 minute standing time in the chemical procedure the students should be able to further acquaint themselves with the instrument and ask any questions.

3. Classroom - Discuss the laboratory performance of the learner.

A PROTOTYPE FOR DEVELOPMENT OF ROUTINE OPERATIONAL PROCEDURES

for the

DETERMINATION OF POTASSIUM USING FLAME PHOTOMETRY

as applied in

WASTEWATER TREATMENT FACILITIES
and in the
MONITORING OF EFFLUENT WASTEWATERS

INSTRUCTIONAL PACKAGE WORKSHEET

National Training and Operational Technology Center
Municipal Operations and Training Division
Office of Water Program Operations
U.S. Environmental Protection Agency

PART II INSTRUCTIONAL PACKAGE WORKSHEET

F. Determination of Potassium Using Flame Photometry

1. Two alternate methods of potassium analysis are provided in the Federal Register, Wednesday, December 1, 1976, Part II, table 1. In both methods, the first step is digestion. The digestion procedure is given in Methods for Chemical Analysis of Water & Wastes, pg. 83, par. 4.1.4), 1974. The analysis phase of the first of the two alternate procedures is atomic absorption, and is given in the same manual, pg. 143. The analysis phase of the second of the two alternate procedures is colorimetric (cobaltinitrite), and is given in Standard Methods, 14th ed, Method 317B, pg 235.

2. The method presented in the associated effluent monitoring procedure (EMP) was taken from Standard Methods, 14th ed, Method 317A, pg 234, and from the Beckman Instrument Manual.

3. The learners will prepare calibration standards, graphs, and analyze a sample provided by the instructor.

GUIDELINES FOR
INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Determination of Potassium Using Flame Photometry

UNIT OF INSTRUCTION:

LESSON NUMBER: 1 of 1

ESTIMATED TIME: 3 hours

JUSTIFICATION FOR THIS INSTRUCTIONAL OBJECTIVE: The learner will need to know how to perform this determination if it is required by his/her wastewater treatment plant permit.

ENTRY LEVEL BEHAVIOR: The learner must be able to:

1. Perform weighings on an analytical balance.
2. Perform weighings on a trip balance.
3. Handle solutions of acids safely.
4. Use pH sensitive paper.
5. Prepare a desiccator for use.
6. Use a hotplate safely.
7. Subtract numbers.
8. Use a pipet.
9. Transfer solids from a weighing boat to a volumetric flask and dilute to the mark.
10. Use wrenches to tighten gas line fittings.
11. Safely anchor cylinders of compressed gases.
12. Use a drying oven.
13. Use a funnel and filter paper to filter a solution.
14. Operate gas pressure regulators.
15. Prepare a calibration graph. See the Effluent Monitoring Procedure on the Preparation of Calibration Graphs, CH.IN.cg.EMP.1a.1.77.

A. INSTRUCTIONAL OBJECTIVE:

1. Terminal Behavior - The learner will determine the potassium content of a sample prepared by the instructor, and will exhibit proper technique during the procedure.

2. Conditions - The learner will have the use of all chemicals and equipment in the EMP.

3. Accepted Performance - Use of proper technique will be judged by the instructor. The potassium concentration found by the learner should be within plus or minus 5% of the true value as determined by the instructor.

B. INSTRUCTIONAL RESOURCES:

1. Available Media: Twenty-four unassembled 2 x 2 slides.

2. Suggested Media: None.

C. INSTRUCTIONAL APPROACH (SEQUENCING):

1. Prior to the start of this laboratory session, the instructor should place about 3 g of potassium chloride in a small beaker, dry it at 110°C for one hour, and cool it in a desiccator. One beaker is needed for each two students since the experiment will be done in pairs.

   Glassware should be cleaned as described in Section A.1. of the EMP.

   Balances and the Beckman Model B spectrophotometer with flame photometry attachments should be in working order.

   Hydrogen and oxygen cylinders should be attached to the instrument.

   The proper phototube should be in the instrument.

   Desiccant in the instrument should be checked.

   A sample of effluent should be on hand (approximately 50 ml per pair of students) and the potassium concentration determined by the instructor. Or, the instructor may prefer to prepare a deionized water sample of potassium chloride.

2. About two hours prior to the start of this laboratory session, the instructor should turn on the instrument for warm-up, and do steps A.3.2. through A.3.5. in the EMP.

   The instructor should also pre-set all gauges on the instrument and gas cylinders as described in F.2.3. through F.2.16.; i.e., just before doing step F.2.17, only the main valves on the two cylinders need to be opened (oxygen <u>first</u>, <u>then</u> hydrogen) by the students.

3. Classroom - discussion (using 2 x 2 slides) about general principles involved in absorbance and emission spectroscopy; contrast the two phenomena. Discuss the component parts of a flame photometer.

4. Laboratory - instructions about safety connected with use of flame photometers (e.g., properly anchored gas tanks, dangers of being burned by the flame).

5. Have the learners do steps B.2.4. through B.2.8.

6. Tell the learners to take a minute to read steps B.2.9. and B.2.10.

7. Tell the learners what the expected potassium concentration in the effluent or synthetic sample is. (This will dictate which potassium standards are prepared by the learners (the intermediate B.3., or standard B.4.).

8. Have the learners prepare the intermediate (B.3.1. through B.3.3.) or standard (B.4.1. through B.4.3.) potassium solutions.

9. In connection with Section C, the synthetic sample would not have to be digested or filtered. The effluent sample may have to be, at the judgement of the instructor.

C. INSTRUCTIONAL APPROACH (Continued):

10. Tell the learners Section D has already been done; i.e., you have turned the instrument on.

11. Have the learners do steps E.2. through E.8.

12. Have the learners do steps F.1.1. through F.1.4.

13. Have the learners familiarize themselves with figures 1, 2, and 3 in the EMP.

14. Have the learners turn on the main cylinder valves (oxygen first, then hydrogen) and then do steps F.2.18. through F.2.52. Do not have them do F.2.48. if another pair of learners is to use the instrument. (It is even desirable to leave the instrument on overnight if it will be used the next day.)

15. Classroom - have the learners do Section G. Discuss possible sources of error if the Accepted Performance has not been achieved.

D. IPW EQUIPMENT AND SUPPLY REQUIREMENTS

For each pair of students:

1. One Beckman Model B spectrophotometer with flame photometry attachments.
2. One oxygen cylinder and one hydrogen cylinder with pressure regulators.
3. One pack of matches to light the instrument.
4. One plastic squeeze bottle of deionized water.
5. Two pairs of safety glasses.
6. Two laboratory aprons.
7. One pencil or pen.
8. One 12 inch ruler.
9. One analytical balance.
10. One grease pencil.
11. One 100 ml pipet.
12. One 10 ml graduated pipet.
13. One pipet bulb.
14. One 1 liter volumetric flask.
15. Six 100 ml volumetric flasks.
16. Eight 5 ml glass beakers (supplied with the instrument) or eight 5 ml plastic disposable beakers.

For the class as a whole:

One desiccator large enough to hold the small beakers of potassium chloride; one beaker for each pair of students.

E. IPW REAGENT REQUIREMENTS

For each pair of students:

1. One beaker containing 3 g. of potassium chloride.

A PROTOTYPE FOR DEVELOPMENT OF
ROUTINE OPERATIONAL PROCEDURES

for the

DETERMINATION OF SODIUM USING FLAME PHOTOMETRY

as applied in

WASTEWATER TREATMENT FACILITIES
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INSTRUCTIONAL PACKAGE WORKSHEET

National Training and Operational Technology Center
Municipal Operations and Training Division
Office of Water Program Operations
U.S. Environmental Protection Agency

PART II INSTRUCTIONAL PACKAGE WORKSHEET

G. Determination of Sodium Using Flame Photometry

1. An alternate method of sodium analysis is provided in the Federal Register, Wednesday, December 1, 1976, Part II, table 1. It is digestion followed by atomic absorption. The digestion phase of the procedure is given in Methods for Chemical Analysis of Water & Wastes, pg. 83, par. 4.1.4), 1974. The analysis phase of the procedure is given in the same manual, pg. 147.

2. The method presented in the associated effluent monitoring procedure (EMP) was taken from Standard Methods, 14th ed, Method 320A, pg. 250, and from the Beckman Instrument Manual.

3. The learners will prepare calibration standards, graphs and analyze a sample provided by the instructor.

GUIDELINES FOR
INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Determination of Sodium Using Flame Photometry

UNIT OF INSTRUCTION:

LESSON NUMBER: 1 of 1

ESTIMATED TIME: 3 hours

JUSTIFICATION FOR THIS INSTRUCTIONAL OBJECTIVE: The learner will need to know how to perform this determination if it is required by his/her wastewater treatment plant permit.

ENTRY LEVEL BEHAVIOR: The learner must be able to:

1. Perform weighings on an analytical balance
2. Perform weighings on a trip balance
3. Handle solutions of acids safely
4. Use pH sensitive paper
5. Prepare a desiccator for use
6. Use a hotplate safely
7. Subtract numbers
8. Use a pipet
9. Transfer solids from a weighing boat to a volumetric flask and dilute to the mark.
10. Use wrenches to tighten gas line fittings
11. Safely anchor cylinders of compressed gases
12. Use a drying oven
13. Use a funnel and filter paper to filter a solution
14. Operate gas pressure regulators
15. Prepare a calibration graph. See the Effluent Monitoring Procedure on the Preparation of Calibration Graphs, CH.IN.cg.EMP.1a.1.77.

A. INSTRUCTIONAL OBJECTIVE:

1. Terminal Behavior - The learner will determine the sodium content of a sample prepared by the instructor, and will exhibit proper technique during the procedure.

2. Conditions - The learner will have the use of all chemicals and equipment in the EMP.

3. Accepted Performance - Use of proper technique will be judged by the instructor. The sodium concentration found by the learner should be within plus or minus 5% of the true value as determined by the instructor.

B. INSTRUCTIONAL RESOURCES:

1. Available Media: Twenty-four unassembled 2 x 2 slides.

2. Suggested Media: None.

C. INSTRUCTIONAL APPROACH (SEQUENCING):

1. Prior to the start of this laboratory session, the instructor should place about 3 g of sodium chloride in a small beaker, dry it at 110°C for one hour, and cool it in a desiccator. One beaker is needed for each two students since the experiment will be done in pairs.

   Glassware should be cleaned as described in Section A.1. of the EMP.

   Balances and the Beckman Model B spectrophotometer with flame photometry attachments should be in working order.

   Hydrogen and oxygen cylinders should be attached to the instrument.

   The proper phototube should be in the instrument.

   Desiccant in the instrument should be checked.

   A sample of effluent should be on hand (approximately 50 ml per pair of students) and the sodium concentration determined by the instructor. Or, the instructor may prefer to prepare a deionized water sample of sodium chloride.

2. About two hours prior to the start of this laboratory session, the instructor should turn on the instrument for warm-up, and do steps A.3.2. through A.3.5. in the EMP.

   The instructor should also pre-set all gauges on the instrument and gas cylinders as described in F.2.3. through F.2.16.; i.e., just before doing step F.2.17, only the main valves on the two cylinders need to be opened (oxygen first, then hydrogen) by the students.

3. Classroom - discussion (using 2 x 2 slides) about general principles involved in absorbance and emission spectroscopy; contrast the two phenomena. Discuss the component parts of a flame photometer.

4. Laboratory - instructions about safety connected with use of flame photometers (e.g., properly anchored gas tanks, dangers of being burned by the flame).

5. Have the learners do steps B.2.4. through B.2.8.

6. Tell the learners to take a minute to read steps B.2.9. and B.2.10.

7. Tell the learners what the expected sodium concentration in the effluent or synthetic sample is. (This will dictate which sodium standards are prepared by the learners (the intermediate B.3., or standard B.4.).

8. Have the learners prepare the intermediate (B.3.1. through B.3.3.) or standard (B.4.1. through B.4.3.) sodium solutions.

9. In connection with Section C, the synthetic sample would not have to be digested or filtered. The effluent sample may have to be, at the judgement of the instructor.

C. INSTRUCTIONAL APPROACH (Continued):

10. Tell the learners Section D has already been done; i.e., you have turned the instrument on.

11. Have the learners do steps E.2. through E.8.

12. Have the learners do steps F.1.1. through F.1.4.

13. Have the learners familiarize themselves with figures 1, 2, and 3 in the EMP.

14. Have the learners turn on the main cylinder valves (oxygen first, then hydrogen) and then do steps F.2.18. through F.2.52. Do not have them do F.2.48. if another pair of learners is to use the instrument. (It is even desirable to leave the instrument on overnight if it will be used the next day.)

15. Classroom - have the learners do Section G. Discuss possible sources of error if the Accepted Performance has not been achieved.

D. IPW EQUIPMENT AND SUPPLY REQUIREMENTS

For each pair of students:

1. One Beckman Model B spectrophotometer with flame photometry attachments.
2. One oxygen cylinder and one hydrogen cylinder with pressure regulators.
3. One pack of matches to light the instrument.
4. One plastic squeeze bottle of deionized water.
5. Two pairs of safety glasses.
6. Two laboratory aprons.
7. One pencil or pen.
8. One 12 inch ruler.
9. One analytical balance.
10. One grease pencil.
11. One 100 ml pipet.
12. One 10 ml graduated pipet.
13. One pipet bulb.
14. One 1 liter volumetric flask.
15. Six 100 ml volumetric flasks.
16. Eight 5 ml glass beakers (supplied with the instrument) or eight 5 ml plastic disposable beakers.

For the class as a whole:

One desiccator large enough to hold the small beakers of sodium chloride; one beaker for each pair of students.

E. IPW REAGENT REQUIREMENTS

For each pair of students:

1. One beaker containing 3 g. of sodium chloride.